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ABSTRACT

This book is the second in a series of four books emphasizing student-oriented problem solving related to environmental matters. It is divided into three activity levels: awareness, transitional, and operational. The activity sequence is designed to motivate students toward a concern for environmental quality, take action related to particular problems or concerns, and provide background for in-depth, on-going problem investigations. Population awareness is developed through study of (1) density, distribution, and diversity, (2) food, clothing, and shelter, and (3) political and social factors. Process-skills emphasize observation, data collection, data recording, and making inferences and predictions based on recorded observations. Each activity identifies the situation and notes open-ended questions, equipment needed, procedure, past students, limitations, and a biography. Transitional activities focus on real problems of the community and extend those of the first level in each of the three study areas. Economic, political, social, scientific, technological, aesthetic, and legal factors are considered. Activity format is the same. Operational activities are an outgrowth of the first two levels. Four approaches to problem solving are presented. They are: simulation, contract projects, debating, and modeling situations. Related documents are SE 016 524 and SE 016 614. (BL)

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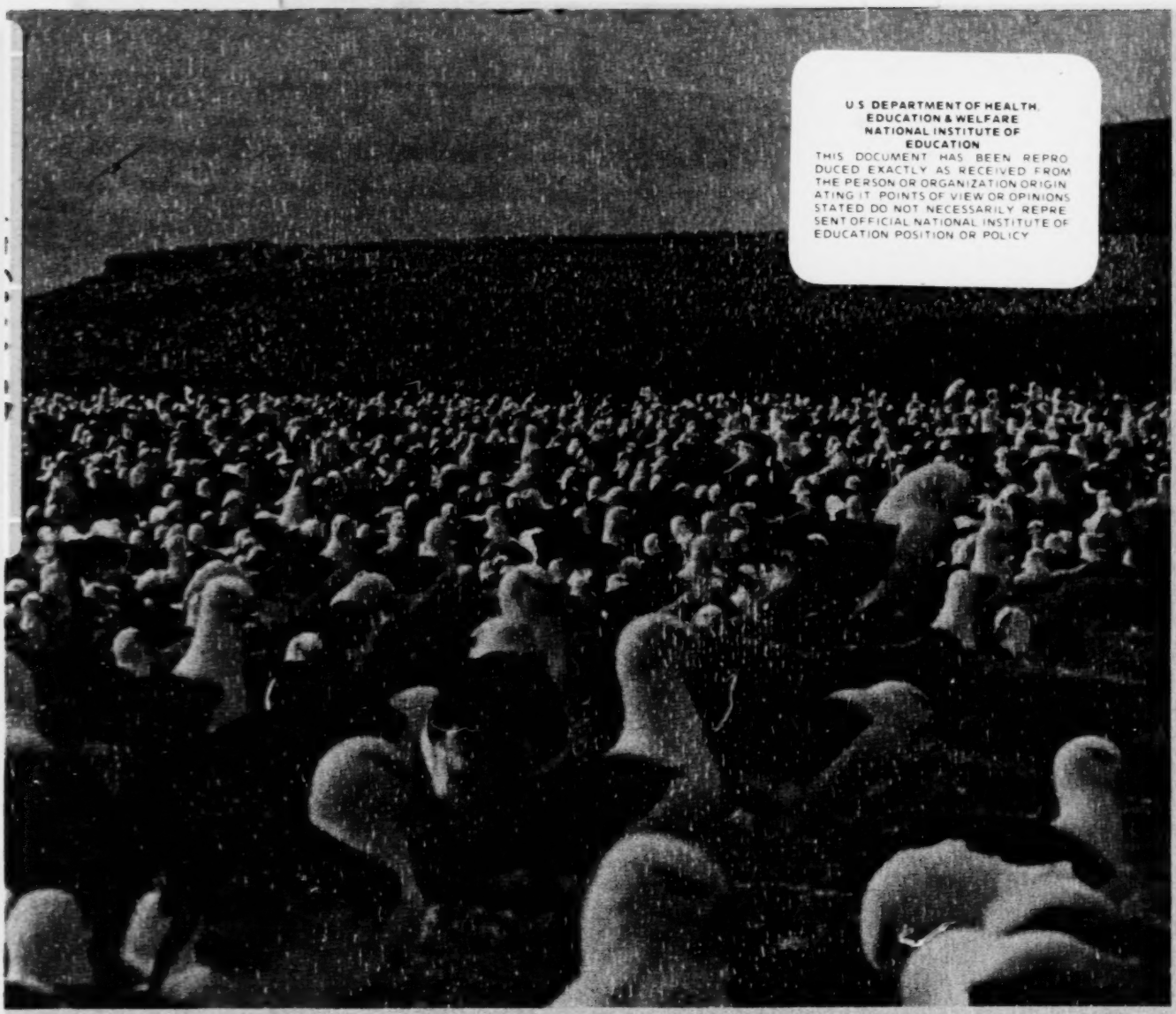

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A CURRICULUM ACTIVITIES GUIDE

To POPULATION And ENVIRONMENTAL STUDIES

BUCKS · MONTGOMERY · CHESTER · PHILADELPHIA · DELAWARE

Produced by

Project KARE BLUE BELL, PENNSYLVANIA Matthew M. Hickey Director

NOTICE

This book is the second in a series of four books produced by Project KARE with a grant from the Office of Environmental Education under Public Law 91-516. The other titles are:

- Curriculum Activities Guide to Solid Waste and Environmental Studies
- Curriculum Activities Guide to In-Depth Environmental Studies
- Curriculum Activities Guide to Water Quality Equipment and Environmental Studies

Additional copies of the books may be obtained from:

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Questions regarding the use of the books may be directed to Project KARE, Colony Office Building, Route 73 & Butler Pike, Blue Bell, Pennsylvania 19422, Telephone: 215-643-7600.

A CURRICULUM ACTIVITIES GUIDE

TO

POPULATION

and

ENVIRONMENTAL STUDIES

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There were many people who contributed to the completion of this document. It is a sequel to A Curriculum Activities Guide to Water Pollution and Environmental Studies, Vols. I and II and as such, it leans heavily on the work of others who went through the ordeal of beginning something. Special thanks go to Donald L. Wright, Director of Project KARE, who encouraged the effort to formulate the Documentation Task Force (DTF) idea and to Allen C. Harman, Executive Director of Montgomery County Intermediate Unit #23, who facilitated the DTF effort in a myriad of ways from board approval to accounting procedures. The cooperation of the Intermediate Units of Bucks, Chester, Delaware, and Philadelphia Counties and the Roman Catholic Archdiocese of Philadelphia is likewise appreciated.

We are grateful to George Lowe, Assistant Director of the Office of Environmental Education, U. S. Office of Education who encouraged us to continue this work. We appreciate the efforts of Joseph H. Chadbourne, President of the Institute for Environmental Education (IEE) who encouraged his program staff and participants to contribute material related to their needs. Many of the activity ideas and past studies come from participants of IEE programs, past and present. In particular, contributions were received from participants of the Cuyahoga River Watershed Project, Quincy Public Schools, and 1972 Summer Training Programs. The coordinating effort was carried out by summer program director, Alan McGowan, Scientific Administrator, Center for the Biology of Natural Systems and Peter Gail, Adjunct Professor, Cleveland State University.

This guide was organized and edited by the team of John Hershey, Alan D. Sexton, and Patricia Sparks. They compiled the contributions of conference participants and the DTF staff writers. The staff writers were: Peter Goldie, Jonathan Gormley, David Kriebel, Robert Lippincott, Jerry Ruddle, Ronald Spencer, Tim Tanaka, and Melissa Weiksnar.

The efforts of Bette Connelly, Sue Faulkner, Diana Geist, and Claire Pilzer made the writers'imperfections tolerable to the DTF.

Since the DTF began, there have been several personnel changes. Matthew M. Hickey has succeded Donald L. Wright as Director of Project KARE. Alan D. Sexton has succeded Mr. Hickey as the Assistant Director of Project KARE. John T. Hershey is no longer associated with Project KARE and is now the Manager of Environmental Programs for the University City Science Center, Philadelphia, Pa. Mr. Hickey and Mr. Sexton are currently administering the DTF.

This book is one of four which are being produced by the DTF. The other three deal with solid waste, homemade water testing equipment, and in-depth studies.

A CURRICULUM ACTIVITIES GUIDE

TO

POPULATION

AND

ENVIRONMENTAL STUDIES

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Environmental education is the study of all things that surround and affect man. Its focus is aimed at the development of an informed citizenry that will be capable of making decisions necessary to solve problems dealing with the quality of our environment. The curriculum of environmental education is contemporary and projective, that is, it deals with issues of the present and requires projects for the future.

The emphasis in this guidebook is on student-oriented problem-solving rather than problem-doing. Students who are involved in problem-solving are active learners. By being actively involved in the problem-solving process they will develop the capabilities of using resources to find information and of using this information to make decisions. As students become involved in the teaching-learning processes they begin to experience success which tends to encourage further learning and involvement.

Relevancy is seen as a major key to involvement. Learning is most meaningful when it is relevant to the studens' needs, abilities, interests and personal as well as social purposes. In order for teachers to deal with transition from more traditional teaching approaches they must begin with the learner and not the subject matter. The teacher must relate to the student through rewarding classroom experience that will meet the personal and social

needs of the student.

The intents of this guidebook are to provide student-oriented activities that will motivate students to pursue more in-depth activities and to provide for independent problem studies. In moving from the more teacher-dominated to the more student-dominated classroom the learner must, in the words of Morris,

> ". . . be encouraged to identify with his subject matter, to identify with it emotionally so that he can announce a personal reaction to it. The teacher's function is to arouse the learner intellectually, spiritually and emotionally. Arousal in the learner will quicken his inner senses to perceive what his learning materials are saying to him; the affective center of 'sensation' will then be in a better condition to react to the materials themselves. For it is in the reaction, and not in the materials, that knowing and learning really takes place.
>
> Therefore, in every subject matter a real effort must be made to involve the learner directly. He must get personally tangled up in the subject matter."(1)

In addition the students must be encouraged to generate ideas, to make decisions, to design and carry through a plan of action and to evaluate that action. The expected roles of the teacher are those of a guide and a participator rather than the ultimate authority.

---

(1)Morris, Van Cleve, Philosophy and the American School, Boston Houghton Mifflin Co., 1961, p. 392.

The aims of the guidebook are to:

1. Aid teachers in dealing with problem-solving skills
2. Provide teachers with problem-focused environmental education activities that:
   a. Are multi-disciplinary
   b. Focus on contemporary issues
   c. Utilize a wide range of resources
   d. Utilize the community as a teaching resource
   e. Help develop favorable attitudes toward man's role in the environment
   f. Encourage student-student and student-teacher participation
3. Provide teachers with a listing of available resource materials
4. Encourage teachers to develop their own activities as a result of student reaction to these activities.

The guidebook is divided into three activity levels: (1) awareness, (2) transitional, and (3) operational problem investigation activities. Those at the first level are designed to increase the students' awareness of environmental problems. The second, or transitional level, provides activities which will allow students and teachers to take action related to particular problems or concerns. The third level provides the background for in-depth, on-going problem investigations.

The initial concern at the first level is an assessment of the students' background regarding environmental issues. Factors that contribute to the students' awareness include: (a) the media, (b) parents, (c) youth organizations, (d) direct interaction of the student with his environment, and (e) classroom instruction. The teacher must utilize the students' backgrounds with respect to these factors through: (a) questioning, (b) discussing, (c) citing examples, and (d) observing student behavior.

The awareness activities are designed to motivate students toward a concern for environmental quality. These activities have been developed with process-skills in mind. The skills that are dealt with at the awareness level include: (a) observation of population components, (b) categorizing of population problems, (c) comparing, (d) measuring, (e) inferring, and (f) questioning. The purpose of a process-oriented development is to set the basis for student-inititated activities. Students will be better able to deal with investigations of their own design if they have had previous experience with process-skills. The transition activities place a strong emphasis on student involvement. Student response is encouraged. The students' need for success can be met through acceptance and positive reinforcement. An atmosphere of acceptance and rapport is needed for teacher-student participation to

be effective.

Transitional activities deal with community concerns regarding the environment. The student is seen as a part of the school which in turn is part of the community. In dealing with the environmental problems of the community students are required to use the community as an educational resource. Most components of society are considered when dealing with environmental problems. These involve economic, political, social, scientific, technological and legal factors.

The focus of the transitional activities is on real problems of the community. When students study in their communities, they greatly increase their awareness of community organization, the availability of materials and equipment, the level of community cooperation and their potential roles as community members. Because these activities are done within the context of the community they are not contained as part of a single discipline nor do they remain contained within the four-walled classroom. In dealing with real problems as an educational approach a multidisciplinary attack develops.

The transitional activities provide openers for the third level, problem-solving. Students gain confidence by performing transitional activities and use these as a foundation from which they can design and develop their own problem investigations. Since

the activities are open-ended, all student contributions are considered. The expectations for the students vary according to the level of their interests and abilities.

The third level is essentially an outgrowth of the first two levels. The students function individually or in groups to investigate, in-depth, specific environmental concerns. The students may initiate their own study and design. They gain direct experience in carrying through investigations in which they are responsible for decision-making regarding data collection, data processing, data evaluation and data utilization. The teachers' roles are primarily those of resource persons and guides to learning.

Once the students have completed their investigations, they are required to examine their findings and to determine what potential impact these findings might have on community action. The students then interpret their results and determine how they can be utilized. In proposing or recommending action they must consider the action and the alternatives to this action relative to a variety of political, economic, legal, social, scientific, and technical factors. The students realize through these investigations that they have definite roles as community members. They become aware of the complexity of both natural and man-made systems, and they realize that they have a responsibility that extends beyond their own

interests and needs. Outgrowths of the investigation include a greater concern for social responsibility, consideration for environmental ethics and a greater awareness of potential career opportunities.

The development of the guidebook from an awareness level to an investigative level depends on the activity design.

Each activity follows a question-oriented format. Open-ended questioning will prevent a mechanistic step by step use of the activities. Questions, therefore, are an integral part of each activity. The questions are of five types: (a) those that lead to the activity, (b) those that initiate the activity, (c) those that continue the activity, (d) those that expand the activity, and (e) those that can be used to evaluate the activity. By encouraging student response in this manner the authority-figure role of the teacher is diminished, and students gain confidence in making decisions and initiate their own study programs.

A sequential order, though possibly implied by the format, is not a necessary criterion for using the guidebook. Teachers and students are encouraged to select those activities that best suit their purposes and needs. Scheduling should be flexible as time restrictions would interfere with the effectiveness of the activities. If a time restriction of several weeks or a term is

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to be used, then those activities should be selected which will fit these shorter periods of time. Each activity provides questions for expanding the activity. These questions should be used as departure points for branching activities. From the few examples presented here teachers and students should be able to write their own activities and to design their own study sequences.

PART I

Part I Population Awareness Draft

The activities in the first three chapters are concerned with motivating the students to develop an awareness and a responsibility for environmental quality relative to populations. Many of the activities provide students with an opportunity to explore population aspects of their community outside the classroom. Emphasis is placed on observation, data collection, data recording and the making of inferences and predictions based on the recorded observations.

Chapter 1. Density, Distribution and Diversity

The activities in Chapter 1 deal primarily with numbers and types of organisms in a given area. They present some techniques for sampling populations and provide opportunities to examine several habitats. The activities are relatively brief and interesting. They demonstrate some simple measurement techniques. Emphasis is placed on observation through measurement.

CHAPTER 1

A. Overproduction - Density Danger

I. Introduction

This activity introduces students to the ideas of plant overproduction and the struggle for survival that arises because of it. In the activity, which can extend to six weeks if desired, the student gains experience in recording quantitative data and in analyzing the data by graphing. Questions and discussions indicate not only the relationship of plant overproduction to the human population, but to fish and wildlife populations as well. The activity is best suited to students from grade four upward.

II. Questions

1. To lead to the activity ask:

a. What do plants require to live?

b. What is density?

c. What is diversity?

d. How do the demands that a forest makes on the earth differ from the demands on the earth made by a densely planted cornfield? (The forest has greater diversity - cornfield has little diversity and greater density; therefore a cornfield robs the soil of certain kinds of nutrients, while a forest draws from a diverse source of nutrients and replenishes soil content as well as depleting it.)

2. To initiate the activity ask:
   a. What is the difference between the three pots?
3. To continue the activity ask:
   a. What accounts for the growth differences you see?
   b. What effect does crowding have on the third pot?
   c. In their efforts to grow and survive, what things are these plants competing for?
4. To expand the activity ask:
   a. What would happen if 100 seeds were planted in the same sized pot?
   b. How does a fish population (in an aquarium, for instance) compare to the radish plant population?
   c. How and for what do fish compete?
   d. How does the human population compete in the struggle to survive?
   e. Can the earth produce enough food to feed the human population?
   f. Should there be a limit to the number of people allowed to live, or will the earth itself ultimately provide the limit?
5. To evaluate students' efforts ask:
   a. Were students cooperative and willing to carry out the activity?

b. Did students attempt to answer the questions?

c. Were the students able to relate the limiting factors of the plant population to factors limiting other populations (such as wildlife and human)?

III. Equipment

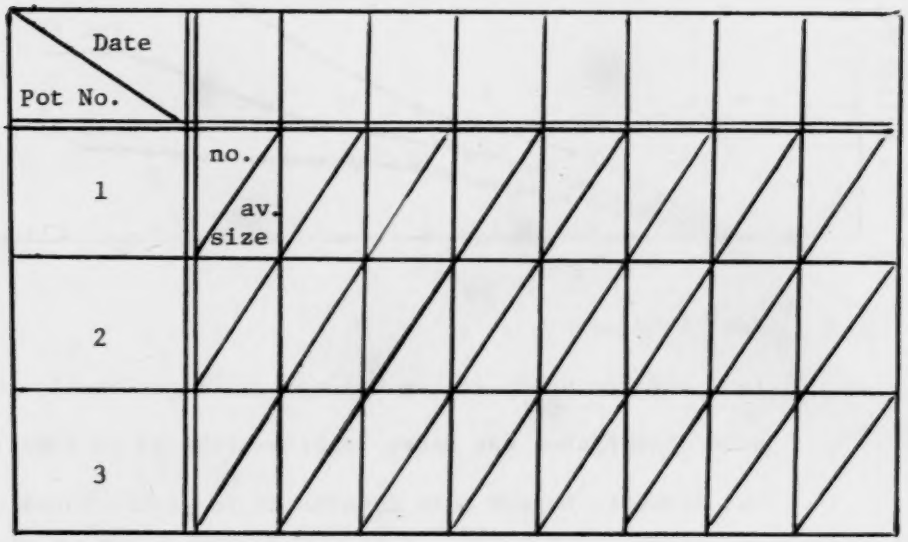
1. For each group participating, three paper cups or three flower pots of equal size.
2. Enough good soil to fill pots.
3. Approximately 50 radish seeds for each group.
4. Paper for graphs and data tables.
5. Rulers to measure plant heights.

IV. Procedure

1. Have students form groups of 3 or 4.
2. Each group should plant 3 or 4 radish seeds in one paper cup or flower pot, 15 in another, and 30 in a third.
3. Each group must make sure that all factors are kept the same for the three pots - temperature, light, soil, and water.
4. In a week the seeds will germinate. Students should count the number of seedlings and determine how many in each pot have survived.
5. Once a week (a shorter time interval may be desired) for three or four weeks, count the seedlings in each

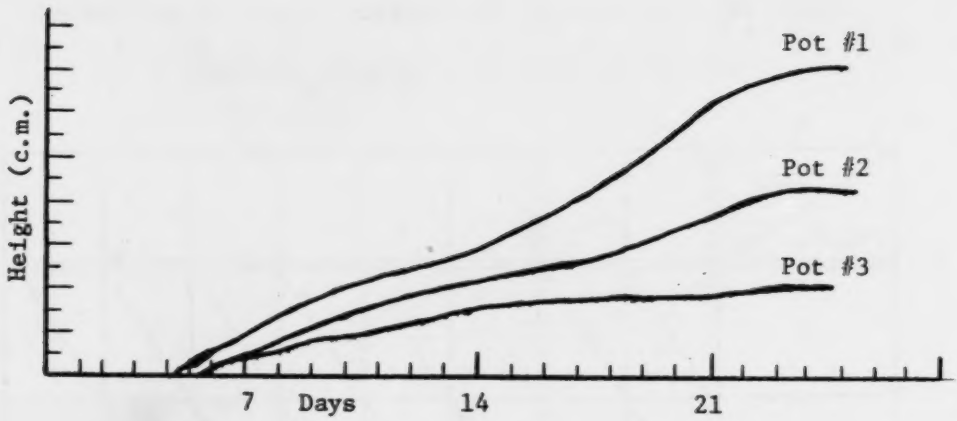
pot, and measure the average height of the plants.

Data may be kept in a table as follows:



Number of Plants/Av. Size

6. Compare the growth and apppearance of the plants in each pot.
7. Predict for each pot how many plants will survive.
8. Allow plants to grow for an additional month and check your predictions.
9. Size variation as related to plant density can be examined by graphing on the same plot, the average size of plants vs. time, for each of the three pots. See following sketch as an example.



V. Past Studies

In a similar study at Log College Jr. High School, where seed orientation was under consideration as an experiment, the students became more interested in growth rates and made strong efforts to record growth relative to the many variables.

VI. Limitations

Plants must be watered regularly in the same manner, and plants should be placed out of the way, so that students don't disturb them.

VII. Bibliography

Ehrlich, Paul R. and Ann H., Stanford University, Population Resources Environment, W. H. Freeman and Company, San Francisco, California, 1970. A comprehensive and detailed analysis of the worldwide crisis of overpopulation and the resulting demand on food, resources and

the environment. The authors draw upon a wide diversity of sources in documenting reasons for growing alarm over mankind's prospects, and they offer constructive proposals that might brighten these prospects. A good text for environmental science and related issues.

Science, Generating Ideas (Teacher's Guide For:), American Book Company, New York, Cincinnati, Atlanta, Dallas, Millbrae, 1972. This activity is adopted from "How does overpopulation affect the survival of plants?" - an investigation found on page 26 of this reference. This science program entitled "Investigating Science" gives direction to childrens' struggle to find out about things, and helps them to benefit from what others have learned. The content of this series is drawn from the major areas of science: the life sciences, the physical sciences, and the earth and space sciences. Experiences in this elementary program will introduce the child to the basic areas of science, in addition to a number of new fields for elementary study (such as environmental science and oceanography).

B. Community Animal Key

I. Introduction

This activity for grades two through nine is an awareness activity designed to get students used to the idea of city wildlife. Total classroom time should not exceed two hours although it should be stretched out over several days.

II. Questions

1. Questions to lead into the activity:
   a. What animals do you see every day?
   b. Are they pets?
   c. Do they visit you?
2. Questions to initiate the activity:
   a. Why do these animals visit you?
   b. Do you have pictures of all these animals?
   c. What animals do you see just once in awhile? Why?
3. Questions to continue the activity:
   a. What makes animals different?
   b. What differences are there in the animals we have named?
   c. How can we put our findings in an order?
4. Questions to expand the activity?
   a. What if we see an animal that we don't know?
5. Questions to evaluate the activity:
   a. How well did the students organize the key?

b. Did they determine that any animal could be identified by using this key?

III. Equipment

Paper, magazines, glue, markers and things found in any classroom are the only materials needed.

IV. Procedure

Have the students chart differences between the animals being very general at first and then getting more specific. In this way, they will make a key.

V. Limitations

There are no foreseen limitations except that if dragged out too long, students could lose interest.

VI. Past Studies

Seventh graders at Germantown Academy in Fort Washington, Pennsylvania, made up a geological key sorting first to color, then hardness, then metalic or non-metalic. Students were amazed when they compared their key with standard keys and found that their key was very similar.

VII. Bibliography

A Curriculum Activities Guide to Water Pollution and Environmental Studies, Institute for Environmental Education, Cleveland, Ohio, 44106, 1970. This activity-oriented guide is the result of cooperative efforts of high school students, teachers, scientists, and technicians. The activities are divided into four

chapters: Hydrologic Cycle, Human Activities, Ecological Prospectives and Social and Political Factors. It has many activities which can be used as examples or as a basis for other activities.

Major, James M., Environmental Education, Objectives and Field Activities, Paducah Public School Environmental Education Staff, 1971. A collection of interdisciplinary activities. Primarily oriented to outdoor education. Offers many helpful hints.

Storin, Diane, Investigating Air, Land, and Water Pollution, Pawnee Publishing Co., Inc., Bronxville, New York, 1971. A collection of activities for students in grades 7-12. Provides background information, materials needed, questions and procedures.

C. Coathanger Plot

I. Introduction

This activity is suggested for grade four and upward. Discussion, questions and complexity of classification can become quite involved if a high school level application is made. The activity lasts a few hours and promotes student awareness of the diversity of small animals, plants, and insects that thrive in almost every corner and niche of the earth's open surface.

II. Questions

1. To lead into the activity ask:
   a. How many bugs or beasts would you say are in one square foot of surface ground?
   b. How many kinds of plants?
   c. What is an organism?
2. To initiate the activity ask:
   a. Do you think you can find any organisms within a coathanger plot?
   b. If so, how many kinds of organisms?
3. To continue the activity ask:
   a. What kinds of beasts can you find?
   b. What difficulties do you have in finding these beasts? Why?

c. What difficulty do you have in watching, catching and observing these bugs? Why?

d. What qualities of your plot allow certain beasts to predominate?

e. What kinds of plants can you find?

f. Is there any one plant or kind of plant that predominates in the plot?

g. If so, why?

h. What kinds of rocks and pebbles do you find in the plot?

i. Why are they different shapes? What may have made them the shapes that they are.

j. Did man have any part in making the rocks the way they are?

k. If you had more or less organisms in your plot than the class average, why did you?

l. Of the entire class, what team had the most organisms?

m. What was different about the plot of this team?

n. Did you find more than one method of classifying and making distinctions among organisms?

5. To evaluate the students' efforts ask:

a. Did the examiners and recorders cooperate?

b. Did they have constructive arguments concerning their method of classification and distinction among organisms?

c. Did students incorrectly assume that there is only one way of classifying?

d. Did students wish to continue the activity in anv way?

III. Equipment

1. Coathangers (pulled out into a circular shape)
2. String
3. Toothpicks
4. Rulers to measure base and height of coathanger
5. Baby food jars if desired
6. Poster paper for diversity charts
7. Sticks or stirring rods(for poking)

IV. Procedure

1. Group the students into pairs.
2. Give each pair or students a coathanger, or toothpicks and string to make a boundary. Toothpicks can be placed in the ground at corners of the coathanger and string placed around the toothpicks. The coathanger can be passed on to the next pair.
3. Have students partition the plot into about four parts with more string. This facilitates counting and examination.
4. One student of the pair should act as examiner, using a stirring rod or stick to poke around and examine the plot.

5. The other student of the pair should act as the recorder, noting all of the different beasts, plants, and rocks that are found. The number of each type should be recorded as well as the number and descriptions of the different types found. To do this, the recorder should keep a data chart listing what and how many are found. The chart could contain the following basic headings:

Beasts	Plants
Flying bugs	Grasslike plants
8 legged bugs	Weedlike plants
Wormlike beasts	Flowering type
Hopping beasts	Moss-like

Rocks (categorize by:)

Color
Size
Shape
Hardness (consistency-make up)

6. Samples of the findings may be taken back to the classroom for further observation. Baby food jars are handy for this purpose.
7. Have students determine the area of ground that they examined, defined by the coathanger: $A = \pi r^2$
8. Have each group then determine the number of living organisms found within that area.

9. Then determine the number of kinds of organisms per plot.

10. Class should then determine the average number of living organisms per coathanger plot.

11. Also, determine the average number of kinds of organisms found per plot.

V. Past Studies

Students are amazed at the number of organisms-plant and animal that they find in the plots. They are also amazed to find so many kinds of bugs and things that they never knew were there.

VI. Limitations

Be sure to confer with the janitor or grounds keeper about the plot sites.

VII. Bibliography

BSCS - Green Version High School Biology, Rand McNally and and Company, 1968. Pages 76-82 are of particular interest in this activity; this section is entitled "Study of a Biotic Community," and contains general investigation procedures, including the Berlese Funnel procedure. The BSCS Green Version High School Biology test is a generally good and widely used text.

Phillips, Edwin A., Field Ecology (A Laboratory Block), D.C. Heath and Company, Lexington, Massachusetts, 1969. This is one of a series of laboratory blocks each of which provides for the in-depth investigation of a specific topic in biology. This block requires approximately six weeks of time to complete in its entirety, however, many good activities can be found to supplement studies of any duration in field ecology.

D. Population Sampling

I. Introduction

This activity enables upper elementary students to gain some understanding of the nature of statistics, as a result of taking random samples of a "population." In this classroom activity, the student is exposed to work with data tables, proportions, and an idea of the varying degree of validity found in statistics.

II. Questions

1. Questions which lead to activity:

a. What is chance?

b. Can you predict the outcome of an event that is dependent upon chance?

2. Questions which initiate the activity:

a. How can we figure out how many beans are in the box for each pea--or vice versa? Is there any other way than counting all of them?

3. Questions which continue the activity:

a. Are there more peas or beans in the mix? (following step 2. of procedure)

b. Why do you think this?

c. Which of the five statements would most likely fit four pieces taken from the box with your eyes closed?

d. Concerning procedural step 8., ask: Is the number of beans for each pea the same when 5 were picked as when 60 were picked? Explain. How do the ratios compare with the 3 beans for each pea that we counted before?

e. What differences are there in counting beans and peas in a box and in counting rabbits and squirrels in a woods? What problems would we have in trying to count rabbits or squirrels in a woods?

4. Evaluate the students' efforts by asking:

a. Did this activity interest the students?

b. Did they wish to extend the study in any way?

III. Equipment

1. One bag of lentil beans and one bag of dried peas.
2. A shoe box or other suitable container.
3. Blank data charts. (if before-class preparation of charts is desired.)

IV. Procedure

1. In a shoe box mix, in a 3 to 1 ratio, a total of at least 1000 pieces of lentil bean and dried pea, respectively.
2. Have each take a small handful of the mixture. Question.
3. Ask students to group in fours and separate their mix into one row of beans and one row of peas.

4. Put the five possible combinations of a random, four piece sampling on the board while students work: 3 beans to 1 pea, 2 beans to 2 peas, 1 bean to 3 peas, 4 beans to 0 peas. 0 beans to 4 peas.
5. After questioning, continue by having students replace their beans and peas in the box. Mix well. Have each student pick four pieces from the box with his eyes closed.
6. Beside each combination on the board, record the number of students that picked that particular combination from the box. Note which combination has the highest frequency, and whether it is the combination that was most expected to occur.
7. Divide the entire box of mix among the class and make a count. Have them calculate the number of beans per pea by dividing the number of beans by the number of peas. They should find approximately the original 3 beans to 1 pea. This activity may be continued to illustrate that the accuracy of conclusions, made on the basis of random sampling, increases with an increase in the number of random samplings made.
8. Have students keep a data chart similar to the following:

Total Pieces	2	5	10	50	100	150	200	250	etc.
Beans/peas									

This is done by randomly picking 2, then 3, then 5, etc., pieces from the 3 to 1 mixture and recording the total number of beans and peas picked to that point. As a result of the questions concerning this part of the activity, the students should be able to grasp that the ratio of beans to peas is usually closer to the actual count of 3 to 1, when a larger sample is taken.

V. Past Studies

Students seem to be quite interested in this activity. A sidelight to the activity, branching from a limitation, is to use different sized peas and beans and to see how this size difference affects mixing and random sampling. Students should find that size difference between bean and pea hinders the accuracy of a small random sample because of the tendency to pick up the larger of the two. However, students should also find that size difference becomes unimportant as the size of the sample becomes very large.

VI. Limitations

The main limitations in this excercise are time and tedium. Time limits the number of random samples that may be taken in class, however, students may wish to continue the activity the following day. Preparing a mix of 1000 peas or beans becomes quite laborious, therefore, students may help in preparation of the mix by counting 25 to 50 bean lots. Uniform

sized beans and peas are recommended because a difference in their sizes makes absolute "random" sampling difficult. If the mix is to be shaken, care should be taken to see that the lid of the container is on tightly.

VII. Bibliography

Button Bags, Environmental Science Center, Golden Valley, Minn. In this upper elementary curriculum materials guide, students work with proportions, graphing, estimation, and random sampling.

Freund, John E., Modern Elementary Statistics, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1960. This text acquaints students with theoretical aspects of statistics. Recommended for high school students.

Huff. Darrell, How to Lie With Statistics, W. W. Norton and Company, 1954. This book is a study of the use and misuse of statistics. It is written in a humorous style and can be understood by high school students. Available in paperback.

Reichman, W. J., Use and Abuse of Statistics, Oxford University Press, New York, 1962. A general work on statistics designed for the high school student which covers the calculation of statistics and their use and abuse.

CHAPTER 2

Chapter 2. Food, Clothing and Shelter Draft

Chapter 2 examines three necessities for life: food, clothing and shelter. As is Chapter 1, the emphasis is on direct observation and the collection of data. Many of the activities can be done by elementary grade students as well as secondary level students. In some instances data sheets are provided but these may be modified to meet the needs of the task and the ability levels of the students.

The focus in these activities is on a broader awareness of the world around us. A broader awareness will make students more sensitive to their environment. Observing, comparing, questioning, measuring, data collection, data recording and inferring are the major process skills emphasized in these activities.

A. Dog News and Dog Views

I. Introduction

This awareness activity is designed to get the students from grade seven upward out of the classroom and into the community for an afternoon as well as to provide an insight into how the community feels and thinks about dogs. Allow an afternoon for this activity, plus an hour of preparation time the day before.

II. Questions

1. Questions to lead into the activity:

   a. Does everyone know what we know about dogs?

2. Questions to initiate the activity:

   a. How much do people know about dogs?

   b. What factors would affect how much they know?

3. Questions to continue the activity:

   a. How can we find out?

4. Questions to expand the activity:

   a. How can we tell people what they don't know?

5. Questions to evaluate the activity:

   a. Did the students realize that environmental factors influence how much a person would know?

   b. Did the students' questions reflect their knowledge and yet assume that the person knew nothing?

III. Equipment

Dittoed questionaire sheets are the only materials needed.

IV. Procedure

Have the kids go into the community in teams of two, each to a designated area. Have the team knock on doors, introduce themselves, and ask if the person would help them by answering a few questions. Warning: tape recorders make people nervous; yes-no questions are best. After the interview give the person a copy of the questionaire with the class's address on the sheet in case the person has any questions later.

V. Limitations

People might be uncooperative. If somebody tells you to "get the hell off his porch, you get the hell off his porch."

VI. Past studies

During a Dog Walk in Cleveland, Ohio, several teachers and students conducted informal (and impromptu) interviews with people on the street about the dog problem.

As an Earth Day activity, students at George School in Newtown, Pennsylvania, did a door-to-door survey of the environmental crisis.

VII. Bibliography

Beck, Alan M., "The Life and Times of SHAG, a Feral Dog in Baltimore", Natural History Magazine, American Museum of

Natural History, New York, New York, October, 1972, pp. 58 through 65. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and our 5:00 A.M. dog walks have really turned people on!

B. Info Inflo

I. Introduction

The purpose of this activity is to learn how to collect scientific data which can be used in evaluating the activity at a feeding station. This activity, as most other activities in this section, assumes an ability to collect and evaluate data. Class time is needed to prepare data sheets and to evaluate data. The activity assumes the establishment of a feeding station; otherwise there are no specific equipment requirements.

II. Questions

1. To lead into the activity ask:
   a. What happens at a feeding station?
   b. What is the meaning of the word, "data"?
   c. How are data helpful?
2. To initiate the activity ask:
   a. What is affecting a feeding station and the activity at it as you look at it?
   b. Which of these criteria change (variables)?
   c. What is the best way to arrange this information on a data sheet?
3. To continue the activity ask:
   a. Who will collect data?

b. When will they be collected?

c. Is everything on your data form valid?

d. What additions/deletions should be made?

4. To expand the activity ask:

a. How do the data change over a period of time?

b. In what activities can the data be put to use?

5. To evaluate the activity ask:

a. Were data collected consistently?

b. Were variations or new discoveries emphasized?

c. Did the students become more proficient at data collection?

III. Equipment

1. Place to make frequent observations, e.g., feeding station, which is accessible by the students.

2. Data sheets.

3. Pencils.

4. Weather equipment if deemed necessary, e.g., thermometer, barometer, anemometer, rain gauge.

5. Watch or clock.

IV. Procedure

1. Make data sheets. A sample follows (see next page).

2. Decide who will observe and when.

3. Evaluate the data periodically.

4. Use the data in other activities. Unused data are

a waste!

Sample Data Sheet for Feeding Station

Date_____

Observer(s)_____

Time observed____:____to____:____

Weather conditions:

Temperature_____

Barometric Pressure_____rising_____falling_____

Wind speed_____mph Direction_____

Cloud Cover _____

Precipitation _____

	No.	Species	Feeder
Species at Feeding Station:	___	_____	_____
	___	_____	_____
	___	_____	_____
	___	_____	_____
	___	_____	_____
	___	_____	_____
	___	_____	_____
	___	_____	_____
Species in feeding area, but not on feeders:	___	_____	_____
	___	_____	_____
	___	_____	_____
	___	_____	_____
	___	_____	_____
	___	_____	_____
	___	_____	_____

Comments:

V. Past Studies

Consistent data collection has often provided information for projects that were not anticipated. It is also the key to any long range project.

Perhaps a weather station and the feeding station could be located in close proximity. A commensal relationship might be established between the groups responsible for each.

Juniors and seniors at Nottingham Academy in Buffalo, New York were assigned in September to conduct a year-round study of a basic community by collecting data at least every day. Enthusiasm waned after the first two weeks. If data are to be collected over a long period of time, periodic checks should be made so developments can be shared and the activity and its purpose not forgotten.

VI. Limitations

If the feeding station is not located in a convenient place, the activity may have to be modified to collecting certain kinds of data which are related to bird activities.

VII. Bibliography

Peterson, Roger Tory, and the Editors of Life, The Birds, Time, Inc., New York, N.Y., 1963. Suitable for grade five upward; chapters cover evolution, flight, feeding, populations, migration, communication, growth and ecological relationships. Photography excells. Very readable.

Pettit, Mary P., My Hobby is Bird Watching, Hart Book Co., New York, New York, 1955. Simply presented, introductory book to bird watching, grade 3 upward could handle. Many references - books, addresses, places - are included. Gives directions for the construction and use of a bird blind.

McElroy, Thomas P., Jr., The New Handbook of Attracting Birds, Alfred A. Knopf, Inc., 1960. This book is "ecological" in orientation. Simple yet thorough ways are presented of attracting birds through feeding, watering, planting, and housing. Care of young and wounded birds and predators would carry the interest from grade six upward.

Weeks, T. A., Teacher Tip, New Bird Ranges and Environment, State of New York, 1970. This article follows a center spread article by Walton B. Sabson, "New Bird Ranges and Environment". It suggests activities and includes a bibliography. Not suitable for class use.

C. Dog Walk

I. Introduction

This awareness activity can really turn people on and get them interested and involved in the dog problem. It is a basic activity that is used in conjunction with other activities such as "Approachability", "Canine Customs", "Photo Peterson" and "Territorial Imperatives" as well as an introduction for any dog activities. A two or three hour walk plus at least an hour of discussion should be planned on for students in grade seven and upward. A class, community group, or interested people can do this activity.

II. Questions

1. Questions to lead into the activity:
   a. What are a dog's needs and dislikes?
   b. Where and when would these be in conjunction?
2. Questions to initiate the activity:
   a. What should we know before starting?
   b. What will we want to know (observe) when we get there?
   c. How can we be sure we won't disturb the dogs?
3. Questions to continue the activity:
   a. How can we cover the most area in the least amount of time?

4. Questions to expand the activity:

   a. How many dogs are owned?

   b. Do you see any "BEWARE OF DOG" signs?

   c. How do the dogs react to us?

5. Questions to evaluate the activity:

   a. The more questions about food, shelter, mortality, pack size, and anything else regarding dogs, the better.

III. Equipment

A notebook or pad and pencil is a must unless a portable tape recorder is employed. The tape recorder is best. A camera and thermometer are both optional, but helpful. Maps are good too.

IV. Procedure

Assemble the interested people (not just the class) at 4:30 A.M. at a pre-designated location to go over last minute instructions, and then split up into groups of three or four people to cover a specific area. Have each person in each group be in charge of certain observations. A tape recorder is expensive, but best because it is hard to write observations and walk at the same time.

V. Limitations

There are unfortunately several with this activity.

Dogs might not be found, or the neighborhood where they are found could present a hazard as well as the safety factor when working with feral dogs. (See the Limitations section in "Approachability"). The main deterent for many people is that they don't like getting out at 4:30 in the morning. But after they do, chances are, they'll be glad they did.

VI. Past Studies

During a summer workshop in Cleveland, Ohio, fifty students and teachers assembled on a street corner at 5:00 A.M. A wide variety of experiences occurred: impromptu interviews, overly-friendly dogs, feral cats and sleepy people.

Three students, two of whom had been on the Cleveland dog walk, had a dog walk in an old suburban Philadelphia housing project and observed over 30 dogs in two hours. A data sheet developed from these two dog walks, follows:

Date_____Time_____to_____

Observers_____

Weather/Temperature_____

Location_____Last garbage pick-up_____

Dog or Pack (if recognized)_____

How Many_____

Sex_____Size_____Type_____

Color_____Distinguishing Marks_____

Collar?_____Intra-Pack distance_____

Source_____

Destination (including activity)_____

_____

Reaction to observers/Flight distance_____

_____

Relationships: dogs, cats, rats, people, packs, cars, garbage _____

Ratios: dog(s) to houses, garbage, litter, abandoned buildings, people, time, weather, packs, with/without collars, "BEWARE OF DOG" signs _____

_____

Pack size, frequency _____

VII Bibliography

Ardrey, Robert, The Territorial Imperative (A Personal Inquiry Into the Animal Origins of Property and Nations), Kingsport Press, Inc., Kingsport, Tennessee, 1966. Robert Ardrey takes a concept familiar to every biologist (that of territory), and brings together for the first time a fair sampling of this form of behavior and demonstrates that man obeys the same laws as (other) animals. Cost: $6.95.

Beck, Alan M., "The Life and Times of SHAG, a Feral Dog in Baltimore", Natural History Magazine, American Museum of Natural History, New York, New York, October 1972, pp. 58 through 65. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and 5 of our dog walks have really turned people on!

"Consumer Watch (A Good Season to Beware of Dogs)", Life Magazine, Time, Inc., Chicago, Ill., August 18, 1972 p. 72. A good, although brief, informative article about how the number of dog bites is on the rise in big cities such as New York and Baltimore.

"Do Cities Really Need Dogs (Do It For Mama)", Time Magazine, Time, Inc., New York, New York, July 20, 1970, p. 35. A well written article on the problem of over-population of dogs in large cities, especially New York.

"Dog Fight (Are City Streets Going to the Dogs?)", Newsweek Magazine, Newsweek, Inc., Dayton, Ohio, April 12, 1971, p. 95. Gives a brief story on the

over-population of dogs in urban areas.

Holmes, C.R., "Let's Defuse Dogdom's Population Explosion", Science Digest, New York, New York, May, 1972, pp. 68 through 73. A good article on the dog population problem around the world.

Klopfer, Peter H., Behavioral Aspects of Ecology, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1962. A very good concise book dealing with topics such as "Why don't predators overeat their prey?", "How are food and space shared between species?", "Why does species diversity vary?", "How are species kept distinct?", and "How are communities organized?". It is too technical at times and the subject index is lacking, but it is thorough and quite concise.

Schoenstein, Ralph, "What Even Your Best Friend--The Dog--Won't Tell You(Unless We Step Smartly We're Going to Land in Alot of Trouble)", Today's Health, Chicago, Ill., July, 1971, pp. 50-53. A brief, humorous story on the over-population of dogs.

D. Pecky Picky Packy

I. Introduction

The purpose of this activity is to determine if there is a preference for different kinds of food among birds. It can be conducted as an awareness activity, because students make first hand observations about food preferences, and evaluate the observations. Much of the observing will probably take place outside of class time, and the experiment can extend over as long a span of time as desired. Other than bird seed and bird feeders, no special equipment is needed. This activity is suitable for any grade level.

II. Questions

1. To lead into the activity ask:
   a. What nutritional requirements do birds have?
   b. What do birds eat?
2. To initiate the activity ask:
   a. Do birds prefer certain foods?
   b. Do they prefer them for taste?
   c. Do they prefer them for texture?
   d. Do they prefer them for availability?
   e. Do they prefer them for the time of year?
3. To continue the activity ask:
   a. Do different species of birds eat different

foods?

4. To expand the activity ask:

   a. How persistent are birds about obtaining the foods they prefer?

   b. How are food preferences acquired?

5. To evaluate the activity ask:

   a. What types of results were obtained?

   b. What conclusions were attained?

   c. How efficient was the execution of the experiment?

III. Equipment

1. For conducting the investigation in a closed situation, needs may include:

   a. bird feeders

   b. food

2. For field observation the following materials might be used:

   a. binoculars (8X if possible)

   b. bird blind

   c. camera

3. Foods which may be used include:

   a. suet

   b. peanut butter

   c. sunflower seeds

d. hemp

e. millet

f. meat

g. cracked corn

h. nut meats

i. dog biscuit

j. chaff

k. raisins

l. dried berries

m. frozen fruits

n. oranges

o. bananas

p. white bread

q. crumbs

r. salt

s. grit

t. pellet-form rabbit food

u. cooked spaghetti

v. boiled potatoes

w. fatty meats

x apple peelings

y. small grains

z. etc.

4. For data collections, needs include:

   a. notebook and pencil; or

   b. blackboard and chalk

IV. Procedure

Note: This is a sample procedure, of which many variations are possible.

1. Set up two pole feeders. Place them close enough to each other so that the surroundings will not introduce many variables because of extreme contrast.
2. Put sunflower seeds in one feeder and on the ground below it.
3. Put only mixed seeds (without any sunflower seeds) in the other feeder and on the ground below it.
4. Observe each feeder at strategic time intervals and note how many birds of each species are using each feeder.
5. Chart results; show which food attracted which species.

V. Past Studies

The two feeders described in the procedure need not be the only feeders in use. They may be set up in already established stations. Different foods might be tried, too.

This is usually an effective method of showing differences

in feeding. With a good variety of birds, differences should be quite clear.

VI. Limitations

Precautions must be taken if continued ground feeding will take place. If a large number of birds are attracted, they may deposit wastes, some carrying disease, thus contaminating foods and spreading disease.

A suitable place for the feeders is needed. If location near the school is a problem, the activity may have to take place as a one day expedition to a "good" area.

VII. Bibliography

Brower, Lincoln Pierson, Ecological Chemistry, Scientific American, W. H. Freeman and Co., 660 Market Street, San Francisco, California 94104, February 1969. Extremely interesting article - would need to be abstracted for grades 10 and under. Describes experiments done with blue jays and monarch butterflies, which were emetic or non-emetic depending on whether or not they were raised on plants (in this case milkweeds) which produced substances poisonous to vertebrates, yet palatable to insects. It also describes how the consumption of emetic as well as non-emetic butterflies caused birds to develop "tastes" and repulsions.

CHAPTER 3

Chapter 3. Political and Social Factors Draft

The activities of this chapter deal with the concept of social interaction among individuals of the same and differing species. The behavior of animals in many cases can be correlated to the behavior of humans. Although the correlations are far from perfect, they do raise many questions relative to influencing factors on man's behavior. Consequently, they provide an added dimension to the students' awareness of population dynamics. Several additional skills such as the recording of observations and polling are developed through the use of these activities.

A. Canine Code

I. Introduction

This awareness activity can be used with any class, grade five or above, depending on the depth of involvement. It should show what laws we have (or don't have) regarding dogs and why they are (or aren't) enforced. It should take two or three hours at least but will probably be spaced out over a week or two.

II. Questions

1. Questions to lead into the activity:

a. Why do we have laws?

b. Are people the only ones who do things wrong?

2. Questions to initiate the activity:

a. What do dogs do wrong?

b. Do we have laws against this?

3. Questions to continue the activity:

a. Are these laws enforced?

b. Who enforces these laws?

4. Questions to expand the activity:

a. Where can we go if we see some wild dog that should be removed? If we see a dog deficating on the sidewalk?

5. Questions to evaluate the activity:

a. Did the students know where to go to get the

information needed?

b. Did the students find out what they now can do about the dog problem in a legal way?

III. Equipment

Telephones should be used (if students can't get interviews) to contact public officials about what laws are on the books. A large roll of butcher paper is good for charting all the laws and responsible agencies.

IV. Procedure

After deciding who is going to know what, get the students talking to public officials about dog laws. After all the information is gathered, have the students chart each step of each law and the responsible agency on large butcher paper.

V. Limitations

Public officials might not know anything or they might be just uncooperative.

VI. Past Studies

Students at George School in Newtown, Pennsylvania, did a study of all laws concerning water quality in the Delaware River Basin and they charted them on large paper.

VII. Bibliography

Beck, Alan M., "The Life and Times of SHAG, a Feral Dog

in Baltimore", Natural History Magazine, American Museum of Natural History, New York, New York, October, 1972, pp. 58 through 65. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and 5 of our dog walks have really turned people on!

Kupecky, Gini, "To Scoop or Not To Scoop", New York Times Magazine, New York, New York, August 20, 1972, pp. 63 through 72. A good article about the battles in New York City over the dog problem. Has much information about both pro-dog and anti-dog organizations.

Schoenstein, Ralph, "What Even Your Best Friend--The Dog--Won't Tell You (Unless We Step Smartly We're Going to Land in Alot of Trouble)", Today's Health, Chicago Ill., July, 1971, pp. 50 through 53. A brief humorous story on the over-population of dogs.

B. Tracks

I. Introduction

This awareness activity for grade five upward allows students to be creative in ways of examining animal tracks. Three or four hours should be allowed for the activity and follow-up discussion.

II. Questions

1. To lead to the activity ask:
   a. Where do the dogs run, play, eat, etc.?
   b. What do dogs do at particular places?
2. To initiate the activity ask:
   a. How many dogs went by here last night?
   b. How can we find out?
3. To continue the activity ask:
   a. What do the dogs always leave behind as a sign that they've been here?
   b. How can we collect or examine these?
4. To expand the activity ask:
   a. If there was a cat here, where would the dog go?
   b. How about another dog? The dog catcher? You?
5. To evaluate the activity ask:
   a. How original were the students' methods of track collecting?

b. Did the students realize that their system was not fool-proof, that dogs might avoid it because of its newness or strangeness?

III. Equipment

Fine sand and plywood of a contrasting color (white sand, knot wood plywood or dark sand, plywood painted white) are really all that are needed for this activity.

IV. Procedure

Have the students look for tracks in the area. Find likely areas that animals would cross frequently. Set the plywood on this place and sprinkle with the sand until totally covered and smooth. Come back the next day and look for tracks in the sand.

V. Limitations

If there are too many tracks, individual tracks might be indistinguishable. People also might scuff up the area. Dogs and cats could avoid the board completely.

VI. Past Studies

Graduate students in a Field Biology course at Temple University used this method for determination of the small mammal population and density in several field sites.

VII. Bibliography

Beck, Alan M., The Life and Times of SHAG, A Feral Dog in

Baltimore, Natural History Magazine, American Museum of Natural History, New York, New York 10024, October, 1972. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and our 5:00 A.M. dog walks have really turned people on!

C. Dog Catcher

I. Introduction

To fully understand the dog problem one must also understand the people connected with it, and so this awareness activity is designed to provide an in-depth look at your friendly neighborhood dog catcher. Several students could spend a whole day with the dog catcher on his rounds, but otherwise this would be a one or two hour activity. For students in grade five and upward.

II. Questions

1. To lead to the activity ask:
   a. Do you have a dog catcher?
   b. How do you know?
2. To initiate the activity ask:
   a. How often do you see the dog catcher?
   b. What does he do?
   c. Would you want to be a dog catcher? Why or why not?
3. To continue the activity ask:
   a. How much is the dog catcher paid? By whom?
   b. Are people satisfied with him?
4. To expand the activity ask:
   a. Does anyone else catch dogs?
   b. What happens to dogs that are caught?

5. To evaluate the activity ask:

   a. Were the students able to determine a dog catcher's social status?

   b. Did the students gain respect and knowledge of the dog catcher?

III. Equipment

There are no equipment requirements except a telephone for use if the students are unable to answer the questions and want to find the answers.

IV. Procedure

After discussing the job and status of the dog catcher, suggest that several students ask the dog catcher if they could observe his daily routine first hand by traveling with him. The students might also be interested in following the energy, manpower and time spent on an average day.

V. Limitations

If you've got a nasty and uncooperative dog catcher (for whatever reason) the most exciting part of this activity is sunk. Otherwise it's great.

VI. Past Studies

Students and teachers in a summer workshop in Cleveland, Ohio, had the opportunity of accompanying a dog catcher on his rounds, but a lack of time prevented them from

doing this.

VII. Bibliography

Beck, Alan M., The Life and Times of SHAG, A Feral Dog in Baltimore, National History Magazine, American Museum of Natural History, New York, New York 10024, October, 1972. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and our 5:00 A.M. dog walks have really turned people on!

Contact your local chapter of the ASPCA.

D. Approachability

I. Introduction

This activity concerns itself with how close one species can get to another. It can be used as a preliminary for "Territorial Imperatives" or by itself to get across the idea of "flight distance". As it is a survey type activity, the more time spent the better, but it could easily be done in an hour or two during a dog walk by fifth graders and older students.

II. Questions

1. To lead to the activity ask:
   a. Do all people like dogs?
   b. What do these people do to dogs?
   c. What do the dogs do?
2. To initiate the activity ask:
   a. Do dogs learn to stay away from people?
   b. How close can we get to dogs?
   c. Standing up? Squatting? Crawling?
3. To continue the activity ask:
   a. How about if we carried ropes and nets?
   b. How do numbers of people or dogs affect how close we get?
4. To expand the activity ask:

a. Can dogs identify dog catchers? (See "Dog Catcher" activity).

5. To evaluate the activity ask:

a. Did students see how territory comes into play?

b. Did students determine that dogs aren't the only animals to which these rules apply?

III. Equipment

No special equipment is needed, just a pad and pencil. A tape recorder is also very handy for taking field notes. Cameras could also be helpful.

IV. Procedure

During a dog walk confront dogs in different numbers with people moving (slowly) toward them, also in different numbers. Note the flight distance and/or barking distance of either or both parties. Try variations--squatting or crawling.

V. Past Studies

On a dog walk in Cleveland, Ohio, several student and teacher groups noted flight distance in relation to the numbers in both parties. It seemed that when the aggressors outnumbered the ones approached, the flight distance increased significantly.

VI. Limitations

Provided dogs are found, the only limitations foreseen

are the safety factors involved when working with feral dogs. Students and teachers should be warned not to show fear, not to make sudden moves, and/or not to run. A small can of aerosol dog repellant, such as HALT, can provide security as well as safety.

VII. Bibliography

Klopfer, Peter H., Behavioral Aspects of Ecology, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1962. A very good, concise book dealing with topics such as "Why don't predators overeat their prey?" "How are food and space shared between species?" "Why does species diversity vary?" "How are species kept distinct?" and "How are communities organized?" It is too technical at times and the subject index is lacking but overall it is thorough.

Beck, Alan M., The Life and Times of SHAG, a Feral Dog in Baltimore, National History Magazine, American Museum of Natural History, New York, New York 10024, October 1972. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and our 5:00 A.M.

dog walks have really turned people on!

Ardrey, Robert, The Territorial Imperative, A Personal Inquiry into the Animal Origins of Property and Nations, Kingsport Press, Inc., Kingsport, Tennessee, 1966.

Robert Ardrey takes a concept familiar to every biologist (that of territory), and brings together for the first time a fair sampling of this form of behavior and demonstrates that man obeys the same laws as (other) animals.

E. Bites

I. Introduction

This awareness activity shows students from grade five upward why feral dogs are dangerous and what can be done about them. No special equipment or knowledge is required for this survey type activity which shouldn't take more than an hour or two of actual class time.

II. Questions

1. Questions to lead into the activity:

a. Do you like big dogs?

b. Do you have a big dog?

c. Who uses big dogs? Why?

2. Questions to initiate the activity:

a. What do these big dogs do?

b. What do wild or feral dogs do?

c. Do you know anyone who has been bitten?

d. Why did he get bitten?

e. What happened to him?

3. Questions to continue the activity:

a. Are other people bitten? Who? How many?

b. Where can we find out?

4. Questions to expand the activity:

a. What can we do to cut down on bites?

b. How do you treat a dog bite?

c. How much would it cost you if you were bitten?

d. What else do dogs do that endangers our health?

5. Questions to evaluate the activity:

a. Did students learn why bites are a problem?

b. Did students determine that bites are not the only problem?

III. Equipment

No equipment other than a telephone (to get information) is required.

IV. Procedure

After the students have figured out who would know the answers to the questions they didn't, have them call on the telephone or better yet, go to an office for an interview.

V. Limitations

The only limitation foreseen is that the people with the information might be uncooperative. This could be minimized by telling why you want the information and what you're going to do with it. Always be honest and polite.

VI. Past Studies

In connection with a study of feral dogs, a graduate student at John Hopkins University in Baltimore, Maryland, did a study of the frequency and severity of dog

bites in Baltimore. His data were based on medical records.

VII. Bibliography

Beaver, D. C., Faust, E. C. and Jung, R. C., Animal Agents and Vectors of Human Diseases, Lea and Febiger, Philadelphia, Pa., 1968. A very technical medical resource. Not applicable to layman.

Beck, Alan M., "The Life and Times of SHAG, a Feral Dog in Baltimore," Natural History Magazine, American Museum of Natural History, New York, New York, October, 1972, pp. 58 through 65. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and our 5:00 A.M. dog walks have really turned people on!

"Consumer Watch (A Good Season to Beware of Dogs)", Life Magazine, Time, Inc., Chicago, Ill., August 18, 1972, p. 72. A good, although brief, informative article about how the number of dog bites is on the rise in big cities such as New York and Baltimore.

Frank, Norman, "A Resurgence of Rabies", Natural History Magazine, American Museum of Natural History, New

York, New York, May, 1972, pp. 14-19, 80-84.

An excellent article on a fast spreading rabies epidemic. The article used a specific case in Florida where several dogs were infected by rabid raccoons.

F. The Order of GRAB (Gouging Relationships Among Birds)

I. Introduction

In this activity students attempt to reveal the existence of a peck order among birds at a feeding station. This is primarily an awareness activity, suitable for most grade levels. Peck orders are often described in biology texts, but this activity allows the students to really observe a peck order in operation. If feeders, food, and a suitable place from which to make observations are established, then the only special equipment needed might be binoculars. Data collected from previous feeding station activities may be helpful at this time, although it can be treated as an activity independent of all others.

II. Questions

1. To lead into the activity ask:

a. How often do individual birds feed at the feeder?

b. How often do groups of birds feed at the feeder?

c. Are these groups members of the same species?

d. Do members of different species feed at the same time?

e. Do the groups descend upon the feeder all at once?

f. What activity takes place at a feeder other than feeding?

2. To initiate the activity ask:
   a. Is there any set order to which birds fall into while feeding?
   b. Are some members of the same species more aggressive than others?
   c. Is this due to their sex?
   d. Is this due to their age?
   e. Who are the aggressive members when more than one species is involved?
3. To continue the activity ask:
   a. Do some species of birds "run" a feeder?
   b. Is aggression active or implied?
   c. Do some species or members of the same species automatically give ground before aggression has actually been shown?
   d. If several species are involved, and the dominant members are absent, how is the peck order affected?
   e. What constitutes aggression (voice, physical contact, etc.)?
4. To expand the activity ask:
   a. How does the intrusion by other birds upon a group which is feeding affect peck order?
   b. Does the peck order at the feeder assume the

same form for activities other than feeding?

5. To evaluate the activity ask:

   a. What was the interest level among the students?

   b. What was the quality of the observation?

   c. What conclusions were drawn?

III. Equipment

1. Feeding station
2. Feed
3. Notebook, pencil, data format
4. Binoculars (optional)
5. Bird blind (if needed)
6. Camera (if desired)

IV. Procedure

Have students devise a uniform method of collecting data, having gone through the questions. This may consist of a formal data sheet, or mere guidelines to help achieve the most useful data possible. Include information, e.g., time and weather, which might be important to the feeder activity, as well as species involved.

Please several kinds of food on the same feeder to attract different kinds of birds to the same place.

Determine the time(s) at which the best data are collected.

Collect data, and evaluate the observations.

V. Past Studies

Students have been amazed at the ability of a pine siskin

to control a feeder with evening grosbeaks on it.

VI. Limitations

Time may be a limitation in that the best time for feeder observation may not coincide with class time. Therefore, this activity may have to take place as more of an "assignment" type activity.

If you cannot establish feeders in the environs of the school, perhaps a day or weekend in the field will allow this activity to take place.

VII. Bibliography

Lanyon, Wesley, E., Biology of Birds, Natural History Press, Garden City, New York, 1963. Suitable for grade seven upward as a non-identification oriented reference. Chapters cover origin and evolution, design for flight, variations on a general theme, migration and navigation, distribution and the environment, courtship and reproduction, growth and survival.

Sanders, A. A., A Guide to Bird Songs, Doubleday, New York, New York, 1951. Presents a unique method of recording bird voices through diagrams. A key to bird songs is included. 200 different songs are diagrammed. Students from grade nine upward might attempt to decipher the curious code used.

Guhl, A. M., The Social Order of Chickens, Scientific

American, W. H. Freeman and Co., 660 Market Street, San Francisco, California 94104, February, 1956. Peck orders are detailed. The emphasis has to do with sexuality rather than peck order and feeding. The contents would need to be abstracted for grade 10 downward.

PART II

Transitional activities allow the students to extend themselves by using equipment, references, audio-visual aids, human resources and the community at large. In so doing, students greatly increase their awareness of community organizations, the availability of materials and equipment, the level of community cooperation and their potential roles as community members. Because these activities are done within the context of the community, they are not contained within the four-walled classroom. In dealing with real problems as an educational approach, a multidisciplinary attack is essential. Many components of society are considered when dealing with environmental problems. These involve economic, political, social, scientific, technological, aesthetic, and legal factors.

Chapter 4. Density, Distribution and Diversity Activities

These activities extend those of Chapter 1. More skills and activity in the community are encouraged. Through these activities students should be able to better understand how communities work and to relate the passage of time to population changes. They will also judge the quality of life in their activities.

CHAPTER 4

A. Population Estimation

I. Introduction

In this classroom activity, a batch of beans represents a living population. Students use the Petersen Population Estimation Formula to estimate the number of beans in the batch. In doing so students are exposed to the ideas of random sampling, marking, predicting, and distribution. They work with a particular formula, data tables and graphing, and they attempt to draw conclusions concerning the validity of their data. Concepts might be grasped by upper elementary students, however, the junior high level is recommended.

II. Questions

1. To lead into the activity ask:
   a. What is population?
   b. What is a population?
   c. Is there any way we could find out how many fish are in a pond, or how many rats live in a city block?
   d. Is counting all of them practical or even possible?
2. To initiate the activity ask:
   a. What is a random sampling of a population?
   b. What makes it "random"?

c. Does uneven distribution affect the "randomness" of a random sampling?

3. To continue the activity ask:

a. What do the marked beans represent in the population? (The animals that were caught, marked, and released in the first sampling).

b. What happens to the accuracy of the population estimate as the number of beans in the random sample increase? Why?

4. To expand the activity ask:

a. Can the Petersen Population Estimation Formula be used in estimating the size of living populations?

b. How can this be done? (Capture, mark and release and recapture animals).

5. To evaluate the students' efforts ask:

a. Did the students appear to be working willingly?

b. What part of the discussion/activity seemed to interest them most?

c. Were the students able to draw adequate conclusions concerning the activity?

d. Were students able to relate the bean "population" to a living one?

e. Do they want to continue with an actual population study?

III. Equipment

Equipment can easily be adapted to availability, especially concerning the bean marking method.

1. A one pound bag (any kind) of light colored beans, black-eyed pea size containing at least 1,000 beans, is sufficient for a group of 4 students.
2. Tempora-waterpaint
3. Strainer
4. Buckets to pour and catch paint
5. Paper for data tables similar to the one following:

m	10	20	30	40	50	60	70	80 etc...
u								
r								
P								

IV. Procedure

Count out in advance, 1000 unmarked beans and roughly 200 marked beans for each group of 4 students. Students can help with the counting and marking the day before the activity. A method of marking which is more economical and more ecologically sound than the use of spray paint is to pour a water base or tempora paint through a

kitchen strainer of beans, and catch the paint in another bucket.

Begin by having students form groups of four. Each group should have 1000 unmarked and 200 marked beans.

Have each group begin by adding 10 marked beans and removing 10 unmarked beans from the batch.

Insure that students mix the beans well, and then each group should remove a handful.

Students should then compute "P" using the Petersen Population Estimation Formula:

$$P = \frac{m(u + r)}{r}$$

P = the estimated population

m = the number of individuals marked and released in the precensus.

u = the number of unmarked individuals caught in the postcensus.

r = the number of marked individuals caught in the postcensus (returns)

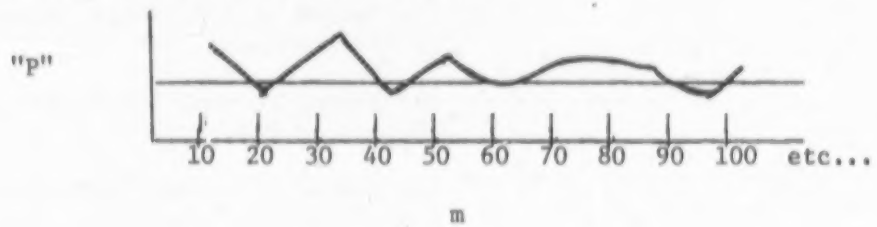
The precensus is the number of marked and released the first sampling (in this activity the 10 marked beans that were added to the bean "population"). The postcensus is the second sampling. When sampling a living population,

ample time must elapse (between the two samplings) for the marked individuals to become randomly distributed in the population. For most wild populations this time should be at least one week; however, local conditions may shorten or lengthen this time.

Students should continue adding 10 marked beans, removing 10 unmarked beans and computing "P" until 200 marked beans are added, keeping a data record of each "P" computation.

A final step is to count all the beans if the actual count is not already known.

By analyzing the computed "P" values and knowing the actual "P" value, the students can determine which combinations of m, u, and r yield the best estimates of "P". One method of examining this relationship is to graph "P" values vs. the increasing "m" values, as follows:



V. Past Studies

In conjunction with the annual draining of the George School Pond at George School, Newtown, Pa., a pond population is estimated using this mothod. The students

clip the end of a pectoral fin of the fish caught in the precensus. Three weeks are allowed to pass between the pre- and postcensus to insure even distribution of marked fish in the pond. Upon completion of the postcensus and computation of the estimated population, students have invariably asked how accurate the estimate really is. In response to this question, George School faculty and students begin the routine draining of the pond, and make an actual count of types and numbers of fish. (Drainage is done to maintain a desired balance in the fish population. Fish are stored in a nearby stream until the pond refills).

Alan P. Ternes, executive editor of Natural History magazine has also used the Petersen technique in urban areas to determine dog populations. The precensus and postcensus were photographs taken from the same spot at the same time in the early morning. Dogs are found to be positively identifiable in the photographs. Domestic cats are not.

VI. Limitations

Limitations in the classroom activity can be attributed to the time and tedium involved in counting out beans. Use student power to aid in this task.

VII. Bibliography

Ehrlich, Paul R. and Anne H., Population Resources

V

Environment, W. H. Freeman and Company, San Francisco Cal., 1970, Detailed analysis of the worldwide crisis of over-population and the resulting demands on food, resources, and the environment. Taking a broad ecological approach, it shows that problems of modern society such as environmental deterioration, hunger, resource depletion, and war are closely related. Authors draw upon a wide diversity of sources and offer many constructive proposals that might help to brighten the gloomy prospects portrayed. An excellent sourcebook for high school and above.

Fruend, John E., Modern Elementary Statistics, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1960. This text acquaints students with theoretical aspects of statistics. Recommended for high school students.

Huff, Darrell, How to Lie With Statistics, W.W. Norton and Company, 1954. This book is a study of the use and misuse of statistics. It is written in a humorous style and can be understood by high school students. Available in paperback.

Lagler, Karl F., Freshwater Fishery Biology, Wm. C. Brown Company, Publishers, Dubuque, Iowa, 1952. A broad, comprehensive volume dealing with the principles and methods of modern fishery research and management

on the inland waters of Canada and the U.S. Much of material is of value to students of ichthyology, marine fisheries, and various aspects of hydrobiology. The book contains a section entitled "Methods of Population Enumeration," which explicates various population estimate formulas, including the Petersen formula.

Reichman, W.J., Use and Abuse of Statistics, Oxford University Press, New York, 1962. A general work on statistics designed for the high school level which covers the calucation of statistics and their use and abuse.

B. The Inconspicuous Organism (Cryptozoa)

I. Introduction

This activity promotes student awareness of the variety and numbers of "between layer" organisms that are found under rocks and both in and under logs. The student investigates the organisms' structures and attempts to attribute certain structural adaptations to the "in-between" habitat and vice-versa. He also ponders the question of whether or not these structural forms lend themselves well to survival in this particular habitat. The activity is suggested for second grade upward and can last anywhere from one hour to a day or two.

II. Questions

1. To lead into the activity ask:
   a. Why do critters live under rocks and logs?
   b. What might prompt these "in-between" critters to live there?
2. To initiate the activity ask:
   a. What kinds of critters can you find in the "in-between" habitat?
3. To continue the activity ask:
   a. What structural similarities do the organisms have?
   b. Dissimilarities?

c. What function(s) can you attribute to these structual forms?

4. To expand the activity ask:

a. Do these critters live in habitats other than under logs and rocks?

b. What advantages does this habitat contribute toward survival?

5. To evaluate the students' efforts ask:

a. Were the students enthusiastic about finding and examining the critters?

b. Did the students react ardently to the questions?

c. Did they wish to continue the activity in any way?

III. Equipment

1. Tweezers, forceps
2. Baby food jars
3. Baggies

IV. Procedure

Send students as individuals or pairs to the area to be studied.

Students should investigate the area and collect samples of creatures that are found.

Turn over logs, sticks, rocks and collect critters.

Split open rotting logs and collect critters.

Take samples back to the classroom to be examined.

If a wooded area is not available for study, place a plank, bricks, or cinder blocks on a grassy section of an open lot. Allow them to sit for a week or two and cryptozoa should then appear underneath.

V. Past Studies

Graduate students in a Temple University course entitled "Ecology and Field Biology", studied the applicability of this activity to the high school level. The work was carried out at the Schuylkill Valley Nature Center in Philadelphia, Pa. They found varied applications for the activity and were surprised to find the interesting outgrowths that can stem from it.

VI. Limitations

Younger children will find it difficult to attribute any reason to particular structural forms. Be sure to gain permission from the grounds people, janitor, or land owner before you begin turning over rocks and things.

VII. Bibliography

BSCS - Green Version High School Biology, Rand McNally and Company, 1968. Pages 76-82 are of particular interest in this activity; this section is entitled "Study of a Biotic Community," and contains general investigation procedures, including the Berlese funnel procedure.

The BSCS Green Version High School Biology text is a generally good and widely used text.

Phillips, Edwin A., Field Ecology (A Laboratory Block), D. C. Heath and Company, Lexington, Massachusetts, 1969. This is one of the series of laboratory blocks, each of which provides for the in-depth investigation of a specific topic in biology. This block itself requires approximately six weeks of time to complete in its entirety, however, many good activities can be found to supplement studies of any duration in field ecology.

C. Underworld Critters

I. Introduction

This transition activity, suggested for second graders and upward, promotes the student's awareness of the wide diversity and numbers of organisms that thrive in the ground. The activity introduces certain laboratory procedures, and can be carried out anywhere from the city (if some open ground can be found) to the backwoods. The duration of the activity can be from 2 periods to several daily periods if desired.

II. Questions

1. To lead into the activity ask:
   a. Where do animals live?
   b. Are there many kinds of animals that live in the ground?
   c. What kinds can you thing of?
2. To initiate the activity ask:
   a. Do you think there are places on the school property where underworld critters live?
   b. Where should we look?
3. To continue the activity ask:
   a. Does your digging spot look like a good place for underworld critters to live?
   b. Why or why not?

c. What kind of critters can you find?

d. What do the critters do that makes them hard to catch?

e. Are some critters found more on the surface ground and others found more deeply in the soil?

f. What purpose does the light have in the Berlese funnel procedure?

g. Why use white paper?

h. What purpose do the chemicals have?

i. Do you find more kinds of critters with the Berlese apparatus than you did just by breaking up the soil?

4. To expand the activity ask:

a. Do some digging spots have more underworld critters than others? Explain.

b. What constitutes a good place for underworld critters to live?

c. What is the relationship between underworld critters and "overworld" critters?

d. What kinds of "overworld" critters eat underworld critters?

5. To evaluate the students' efforts ask:

a. Were students cooperative within their groups?

b. Did they wish to continue the activity in any way?

III. Equipment

1. 2 shovels per team
2. 4 cardboard boxes per team (use 8 paper shopping bags, if necessary)
3. A dozen baby food jars per team
4. Berlese Funnel Sample Set Up
   a. Ether or chloroform
   b. White paper
   c. Light source (75 watt bulb)
   d. Tweezers
   e. Bottle and cap
   f. Formalin or rubbing alcohol
   g. Funnel
   h. Screening (scrape)
5. Microscope

IV. Procedure

Divide the class into teams of 4 or 5, and send the students to the selected sites. Let them collect a cubic foot of soil by digging a foot square 1 foot deep.

Put the soil in the cardboard boxes or bags. Cover. Seal. (Put some surface soil and loose organic litter in a baggie).

In the classroom, sort the material to find the underworld

critters. (Use the surface soil in the baggie to do a Berlese Funnel Sample).

Put each kind in a separate jar, do a diversity index (See activity entitled Classroom DI.) and compare D.I.'s of the different locations.

V. Past Studies

Students are amazed at the number and diversity of organisms that they find in their diggings. The chemicals used in the Berlese funnel apparatus prompt many questions.

VI. Limitations

Get permission from the janitor or grounds personnel before you dig. If the school won't allow digging, look for a friendly school neighbor. Be careful about lifting soil, a cubic foot will weigh from 70 lbs. on up. Be careful to not let the students taste or sniff the alcohol, formalin, ether, or chloroform. They will be curious.

VII. Bibliography

BSCS - Green Version High School Biology, Rand McNally and Company, 1968. Pages 76-82 are of particular interest in this activity; this section is entitled "Study of a Biotic Community," and contains general investigation procedures, including the Berlese funnel procedure. The BSCS Green Version High School Biology text is a generally good and widely used text.

Phillips, Edwin A., Field Ecology (A Laboratory Block), D. C. Heath and Company, Lexington, Massachusetts, 1969. This is one of a series of laboratory blocks each of which provides for the investigation in depth of a specific topic in biology. This block itself requires approximately six weeks of time to complete in its entirety, however, many good activities can be found to supplement studies of any duration in field ecology.

D. Tanglefoot Board

I. Introduction

This transition activity helps the student to become aware of the multitude of different flying organisms present in the air. A diversity index (DI) is computed for each of several investigation sites and comparisons are made. The activity is suggested for students from grade four upward. The usual duration of the activity is about one week.

II. Questions

1. To lead into the activity ask:
   a. What kinds of organisms are airborne?
   b. What factors are required for their survival?
   c. How is their ability to fly an advantage?
2. To initiate the activity ask:
   a. How could you collect flying organisms?
   b. How could you be sure you had a representative sample?
3. To continue the activity ask:
   a. What structural similarities do the organisms have?
   b. How are they dissimiliar?
   c. Judging by the side of the tile the organism is stuck on, and the position of the tile in the tree, can you make a decision about the direction

a particular type usually flew? (Toward the creek or away from it; toward the road or away from it, etc.)

d. If an organism seems to have this "directionality", why might this be so?

e. Are differences as apparent in the DI's of the different areas? Explain.

4. To expand the activity ask:

a. What predators prey upon these flying organisms?

b. Does the probable predator density variation reflect a similar variation in the DI's computed for each area?

c. Why or why not? Explain.

5. To evaluate the student's efforts ask:

a. Were the students interested in catching and examining the flying organisms?

b. Did students react well to the questions?

c. Did students wish to continue the activity in any way?

III. Equipment

1. Several light colored floor tiles (at least 6" x 6")
2. Common auto grease or vaseline
3. Wire (enough to hang each tile by two holes)
4. Drill, or large nail and hammer (to make holes in the tile)

IV. Procedure

Drill two holes, one in each of two consecutive corners of the tile, large enough for the wire to pass through.

Rig the wires in the corners o fthe tile in such a way that the tile can be hung from a tree limb or lamp post.

Thoroughly cover the tiles with grease; an even coating of 1/4" is usually sufficient.

Hang tiles on the limbs of trees in varied locations. Try to select trees that are in different types of habitats; i.e. lawn, field, by a street, creek bank, etc.

Return several days to a week later and check the tangle-foot boards for trapped insects. If a good number of insects are present, return the tiles to the classroom for investigation.

Run a diversity index on each tile of different location and compare.

V. Past Studies

Students at Doyle Elementary School in Doylestown, Pa. were very interested to find that they could tell exactly when insect hatches occurred in the streams. They would find very little on the boards for a certain time and then they would find high numbers of organisms, indicating

a hatch.

VI. Limitations

Floor tiles covered with auto grease are very messy. They should be handled by the wires. One week may not be long enough for a good sample.

VII. Bibliography

Odum, Eugene P., Fundamentals of Ecology, W. B. Saunders Company, Philadelphia, 1971. An excellent basic ecology text; world famous and widely used.

E. Photo Peterson

I. Introduction

Grade seven students can do this transitional activity which provides some very valuable data relative to the dog problem, namely how many dogs there are. This activity is done on two dog walks so no extra time need be allotted.

II. Questions

1. To lead to the activity ask:
   a. How many different dogs do you see each day? Each two days? Each week?
2. To initiate the activity ask:
   a. How many dogs don't you see?
3. To continue the activity ask:
   a. How many dogs are there?
   b. How can we find out?
4. To expand the activity ask:
   a. How accurate is our estimate?
   b. How can we check it?
5. To evaluate the activity ask:
   a. Did the students realize the inaccuracies of this method?
   b. What did the students do with the data after collection?

III. Equipment

A still camera and plenty of film are the only required materials.

IV. Procedure

On two different dog walks take photos of every dog seen. Using the formula below, calculate the population.

$$P = \frac{m(u + r)}{r}$$

P = Population

m = Photographed Walk #1

u = Photographed Walk #2, not in Walk #1

r = Photographed Walks #1 and #2.

V. Limitations

The cost of film and processing should be the only drawback.

VI. Past Studies

Students at George School use this method for finding fish populations, except that instead of photographing, they clip the fins when fish are caught in a large net.

Biologists use this method frequently whether they use photography, tagging, fin clipping or whatever as the method for marking.

A graduate student at Johns Hopkins University in Baltimore, Maryland, used this method and others and in connection with

the state veterinarian estimated the pup-population of Baltimore at 100,000!

VII. Bibliography

Klopfer, Peter H., Behavioral Aspects of Ecology, Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1962. A very good, concise book dealing with topics such as "Why don't predators overeat their prey?" "How are food and space shared between species?" "Why does species diversity vary?" "How are species kept distinct?" and "How are communities organized?" It is too technical at times and the subject index is lacking but overall it is thorough.

Do Cities Really Need Dogs, Time Magazine, New York, New York, July 20, 1970. A well-written article on the problem of over-population of dogs in large cities, specifically New York.

Dog Fight, Newsweek Magazine, Dayton, Ohio 45401, April 12, 1971. Gives a brief story on the over-population of dogs in urban areas.

Holmes,C. R., Let's Defuse Dog-dom's Population Explosion, Science Digest, New York, New York 10019, May 1972. A good article on the dog population problem around the world.

Beck, Alan M., The Life and Times of SHAG, A Feral Dog in Baltimore, Natural Hisotry Magazine, American Museum of Natural Hisotry, New York, New York 10024. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and our 5:00 A.M. dog walks have really turned people on!

Schoenstein, Ralph, What Even Your Best Friend the Dog Won't Tell You, Today's Health, Chicago, Illinois 60610, July 1971. A brief, humorous story on the over-population of dogs.

CHAPTER 5

Chapter 5 extends the awareness of essentials developed in Chapter 2 by allowing more extensive measurements to be made over longer periods of time. Emphasis switches to relations among individuals regarding the essentials of life. Whereas the awareness activities focused on direct observation to assess the status of a situation or condition, the activities in this chapter are considered transitional in that in addition they focus on change. In these activities students are allowed to make presumptions which can then be tested. Process skills developed through the use of these activities include hypothesis development and testing and data collection and evaluation.

A. Dog Food

I. Introduction

This is a survey type transitional activity that can really get the community involved in both the dog and rat problems. This is good for fifth graders and up and should take anywhere from two hours to two weeks depending on whether or not community involvement is your goal. No equipment is required unless advanced students (high school) plan to do stomach content or feces analysis.

II. Questions

1. Questions to lead into the activity:
   a. Why is one dog fat and one thin?
   b. How much difference can you observe?
   c. Why does this amount vary?
2. Questions to initiate the activity:
   a. What do dogs eat?
   b. All dogs?
   c. Why do different dogs eat different things?
3. Questions to continue the activity:
   a. Where do wild, or feral, dogs get food?
   b. Do people feed them? Directly? Indirectly?
   c. What do you do with your garbage?
   d. Is it dog or rat proof?
   e. Do you ever have to clean it up after it's been knocked

over?

f. What's left?

4. Questions to expand the activity:

a. How does the garbage pick up system relate to how dogs eat?

b. How can we cut down on the dog and rat problem?

c. How can we find out what a dog or rat has eaten?

5. Questions to evaluate the activity:

a. Did students learn how dogs feed rats?

b. Do students now know how they contribute to dog and rat problems?

III. Equipment

If advanced students want to do stomach content or feces analysis of either dogs or rats, basic disecting tools plus a microscope are needed. If this is not being done, there are no equipment requirements.

IV. Procedure

Have the students observe dogs feeding and then examine the "kill" to determine what has been eaten. Students could organize a community clean-up campaign to lessen the feed availability. Advanced students could analyze the stomach content or feces of dog or rat to determine what has been eaten.

V. Limitations

None are seen except in the advanced level where stomach content and feces analysis could present a health hazard to those doing

them.

VI. Past Studies

A graduate student at Johns Hipkins University in Baltimore, Maryland, observed the feeding habits of the dogs he was studying for his thesis.

VII. Bibliography

beck, Alan M., "The Life and Times of SHAG, A Feral Dog in Baltimore", Natural History Magazine, American Museum of Natural Hisotry, New York, New York, October, 1972, pp.58 through 65. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and our 5:00 A.M. of our dog walks have really turned people on!

Frame, George W., "Wild Dogs of Africa," Science Digest, New York, New York, June, 1970, pp. 33 through 38. A good article of how wild dogs (in packs) behave in an undisturbed environment.

Klopfer, Peter H., Behavioral Aspects of Ecology, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1962. A very good, concise book dealing with topics such as "Why don't predators over-eat their prey?", "How are food and space shared between species?", "Why does species diversity vary?", "How are species

kept distinct?", and "How are communities organized?" It is too technical at times and the subject index is lacking, but overall it is thorough.

Schaller, George B., "Predators of the Serenget: Part 2 (Are Your Running With Me Hominid?)", Natural History Magazine, American Museum of Natural History, New York, New York, March, 1972, pp. 60 through 69. An excellent article overall, this part (#2 of 3), has a very good account of the activities of naturally wild dogs.

B. Dog Houses

I. Introduction

This survey type transitional activity is good for students from grade five upward. Community action can come into play with the higher grades. It shows the students where dogs hide out and hopefully motivates them to get rid of the places. It should take an hour or two of class time if no community action is planned, but if it is, allow several more hours in class and even more out of class.

II. Questions

1. To lead to the activity ask:
   a. What do dogs do in the rain?
   b. Where do dogs live?
2. To initiate the activity ask:
   a. How can you tell where a dog is living?
   b. Do you know of any places like that?
3. To continue the actvity ask:
   a. Are there any places like that around your house?
   b. What could you do about it?
4. To expand the activity ask:
   a. If you can't pressure your neighbors into cleaning up, who can?
   b. Who should clean up a vacant lot?
5. To evaluate the activity ask:

a. Were students able to identify dog shelters?

b. Did the students realize what could be done about eliminating dog shelters?

III. Equipment

A flashlight might be handy for looking in old washing machines, refrigerators, under porches, etc.

IV. Procedure

Have the students watch dogs, where they come from, and where they go. Then search out possible dog homes and see what community or legal action will be necessary to get rid of these dog homes.

V. Limitations

People might think that you're stirring up trouble which could be difficult for the school.

VI. Past Studies

A student group at Trinity Lutheran Church in Philadelphia, Pennsylvania, had a clean-up program to remove anything that would provide shelter or homes for rats. It was done in connection with the city authorities.

VII. Bibliography

Klopfer, Peter H., Behavioral Aspects of Ecology, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1962. A very good, concise book dealing with topics such as "Why don't predators overeat their prey?" "How are food and space

shared between species?" Why does species diversity vary?" "How are species kept distinct?" and "How are communities organized?" It is too technical at times and the subject index is lacking, but overall it is thorough.

Beck, Alan M., The Life and Times of SHAG, A Feral Dog in Baltimore, National History Magazine, American Museum of Natural History, New York, New York 10024, October, 1972. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and our 5:00 A.M. dog walks have really turned people on!

C. The Family Game

I. Introduction

The purpose of this activity is to introduce students to the concept of families among birds. The collecting of characteristics of birds and then trying to classify the birds from these is the occupation of this activity. However, the identification goes only to the level of family. Being able to recognize families is a key to identification of birds. This makes the activity suitable for beginners with bird activities, and needs no prerequisite activities. The activity consists of at least one class period of data sheet construction, one of observation, and one of using references. Students of any grade can participate in this activity, although it may need simplification for younger (under grade five) students. Field observation aids may be needed. The activity can transpire either at an established feeding station or in a more "natural" setting. By being familiar with families, students are able to narrow their choices in a field guide to only a few birds. Then they can find species with greater ease.

II. Questions

1. To lead into the activity ask:

   a. Why bother to group birds?

   b. What is the meaning of "families" of birds as used in field guides and other bird books?

c. What are some of the criteria for placing birds together in families?

d. Are most of the criteria observable? Can you place a bird by sight instead of undertaking laboratory analyses?

2. To initiate the activity ask:

a. What color(s) is the bird?

b. What "field marks" does it possess?

(1) What is its size as compared to a standard object?

(2) Is its shape chunky or slender?

(3) Do its wings have pointed or rounded tips?

(4) Are it legs proportionately long or short?

(5) Is its bill long or short?

(6) Is its bill thick or thin?

(7) Does it have a crest or top knot?

(8) Is its neck long or short?

(9) Is its tail forked, notched, square tipped, round tipped, or pointed?

(10) Is its tail long or short?

(11) Is its breast unmarked, spotted, streaked or striped?

(12) Does the tail have any marks, e.g., bands, spots, or definite side colors different from the rest of the tail?

(13) Does it have a rump patch?

(14) Do the wings have bars of color or not?

(15) Is there any special eye marking, e.g., a stripe over it, a ring around it? Does the crown have a stripe, or does the crown have a patch?

c. What is the activity?

(1) What is the tail position?

(2) Is it cocked up or down, or is is wagging?

(3) As it climbs trees, does it proceed spirally or head first?

(4) Does it feed on the ground?

(5) On the ground, does it walk or hop?

(6) Does it rummage through any debris?

d. Does it fly?

(1) Does is fly in a straight or up and down line?

(2) How rapidly do the wings beat?

(3) Does it fly in a flock?

e. Is it a water bird?

(1) Does it swim?

(2) Does it do a straight or dabbling dive?

(3) How does it "take off"?

(4) Does it wade?

(5) Does it probe?

(6) What are its motions?

(7) Does the tail exhibit light patches, stripes, a solid color, or black tips?

3. To continue the activity ask:

a. What is its voice like?

b. Where is the bird found?

c. When is it found?

d. What ecological niche does it occupy?

e. What else need we know to place it in a family?

f. Do you agree that some of the birds which have been placed together in the same family should have been?

g. Should some birds of different families be placed together?

h. What were the most helpful and least helpful data collected?

4. To expand the activity ask:

a. What other grouping criteria are there that are not readily observable?

b. How closely do species of some families resemble those in others in appearance and habitats?

c. An ambitious student may wish to construct a dichotomous key based upon the species observed.

5. To evaluate the activity ask:

a. Did the students make thorough observations?

b. Were they "turned on" by the activity?

c. How accurate was their placing of birds in families from the data?

d. Are they able to recognize families by pointing out characteristics?

III. Equipment

1. Data sheets
2. Pencil
3. Binoculars
4. Bird blind if necessary
5. Camera
6. Tape recorder
7. Plenty of field guides and identification books
8. Place to observe birds - either established feeding station or other place where different species are attracted.

IV. Procedure

Using the questions, arrive at a uniform means of collecting data - e.g., a data sheet. Arrange the data collection method - e.g., one group may be responsible for certain characteristics. Take data. Include drawings, photos, sound recordings and group birds in families based on data selected.

V. Limitations

Unless a wide variety of birds is observed, there is not much point to conducting the activity. Choose a place for observation that is almost "guaranteed" to harbor birds. If having a large group of students observing the same birds from the same place is inconvenient, divide the students into teams.

VI. Bibliography

Griscom, Ludlow, Audubon's Birds of America, The Macmillan Co., 1950. A full page is devoted to each of 288 different birds of North America. A brief caption includes a general idea of the birds preferred habitat and where each is found in the United States. Also, popularity, length, wingspread, and/or any noteworthy characteristics are included. Students from grades 3 and upward could find it helpful.

Zim, Herbert S., and Gabrielson, Ira N., Birds, Golden Press, New York, New York, 1963. Very readable guide, suitable from grade 3 upward. The print is large; and there are 129 color plates of birds. Maps of the continental U.S.A. accompany each bird. The summer and winter ranges are shaded. Size and characteristics are given. An introduction, including equipment, observation, clues, and and identification guidelines are given. The book is

designed for use in the field.

Booth, Ernest S., Birds of the East, College Press, Keene, Texas, 1962. Book is designed as a field guide for ages 10-85. Dichotomous keys accompany the orders and families of birds. Birds are then identified by description, nest, voice, and distribution. A forty-eight page color centerfold of birds appears. The appendix covers eggs and nests, photography, feeding tables, nesting boxes, banding, and bird references of all types.

Peterson, Roger Tory, A Field Guide to the Birds, Houghton Mifflin, Boston,Massachusetts, 1947. Small print perhaps unsuitable for students younger than grade nine. Obviously not for the beginner. Field marks, voice, range, and similar species are listed for each type bird. 1,000 illustrations, 500 in full color, adorn "the standard book for field identification".

Peterson, Rober Tory, How to Know the Birds, An Introduction to Bird Recognition, Riverside Press, Cambridge, Mass., 1962. Readable introduction to bird watching and identification. Simple manner of presentation suitable for grade five upward. After a section on what to look for, typical members of 54 families are noted with an informal caption. Over 200 species are illustrated either in 400 drawings or on 24 color plates. There is a section on

habitats, and also on silhouettes of common birds, perhaps the book's most distinctive feature.

Cruckshank, Allan, A Pocket Guide to Birds, Dodd, Mead and Co., New York, New Yor, 1952. Paper back approaching identification through the recognition of family groups, useable by the beginner. There are 72 color photos and 78 drawings. It includes birds of Eastern and Central North America.

Chapter 5

D. Operation HABITATS

(Helping Attract Birds In To Artificial Temporary Settlements)

I. Introudction

Operation HABITATS actively involves students in the design, construction and maintenance of bird feeders. It qualifies as a transitional activity, because students must consider a wide range of criteria, covered in the following questions. However, although the construction may be a one-day activity, the students must assume the responsibility for the feeder. Bird feeders can be of a very simple construction, but in many cases special equipment and materials must be used. Kindergarteners can make and enjoy simple feeders; older students can come up with challenging designs.

II. Questions

1. To lead into the activity ask:

   a. Have you ever fed birds before?

   b. What did you feed them?

   c. Where did you feed them?

   d. Why did you feed them?

   e. What kinds of birds are in this area at this time of year?

   f. What is their source of nourishment?

   g. How often do they feed?

2. To initiate the activity ask:
   a. Would the establishment of bird feeders have a a helpful or harmful effect?
   b. For what kind of bird(s) should the feeder be designed?
   c. What is the best design?
   d. What is the best location for the feeder?
3. To continue the activity ask:
   a. What kind of feed should be provided?
   b. How much will be needed?
   c. How often will replenishment be necessary?
   d. Will this be the birds' only source of food?
4. To expand the activity ask:
   a. Who will assume responsibility for continuing the feeder?
   b. What would the consequences be if maintenance of the feeder were suddenly suspended?
   c. Has anyone else in the area had experience with bird feeders?
   d. Can they be sources of information to us?
   e. What provisions will be necessary to accommodate seasonal change?
   f. Will animals (e.g., squirrels) interfere?

g. Was any type of feeder or food preferred?

5. To evaluate the activity ask:

a. How efficient was the design of the feeders?

b. How efficient was the construction of the feeders?

c. How well are the feeders maintained?

III. Equipment

Equipment needs are as varied as the feeders. Usage of scraps should be encouraged for economical as well as ecological reasons.

1. Construction materials

a. Milk cartons

b. String or wire

c. Lumber (boards and dovellings)

d. Screws, nails, nuts, bolts, etc.

e. Tin cans

f. Cups of various types, shapes and sizes.

g. Pine cones

h. Screening

i. Glass plates

j. Aluminum pan

2. Equipment

a. Saws

b. Drill

c. Hammer

d. Scissors

e. Screwdrivers

3. Feed

a. Suet

b. Various grains

c. Nuts or nut butters

d. Fruits -dried and fresh

e. Breads

IV. Procedure

Arrive at criteria using the questions to determine the feeders to be constructed. Then divide the labor and design, construct and maintain them.

v. Past Studies

The time of the average school year coincides with a convenient timing consideration of bird feeders. The feeders can be introduced in the fall, to get the birds familiar with the feeder before winter. As spring comes the use of the feeder can be tapered before summer, when they don't need for a supplementary food source and when students are not present. Oftentimes migratory birds make appearances at feeders - a chance to see varieties not normally encountered. The following six ideas for bird feeders have come from the Burgundy Wildlife Camp after repeated summers of observation:

a. The hanging feeder is a must for any area. It should

have a top to protect it from rain and snow and may have a piece of wood connecting the top and bottom, with holes for suet or other foods. It should also have a small border around the bottom to keep the seeds from rolling off.

b. The pole feeder is effective for an area where there are no trees from which to hang a feeder, but this will only attract the birds that don't feed on the ground.

c. A suet feeder that is nailed to the side of a tree or hung from a branch or wire may attract woodpeckers and other birds which are not attracted to seeds. Hardware cloth or grape bags are good for making them.

d. A "self filling" feeder can be hung or put on a pole. With glass on the sides (as walls) the feeder can be filled with seeds for a long period of time and the observer can see when the seed is low. As the birds eat the seeds, more fall into the platform.

e. A window feeder is attached to the window ledge. It can be filled from inside and is excellent for close observation. It can be a simple platform or can have a roof for more protection.

f. The simplest way to feed birds is to just spread the feed on the ground. This is not really being lazy. Some birds prefer feeding on the ground.

VI. Limitations

Do not neglect the feeders after they are established. When birds have begun to depend on the feeders for food, bad weather and an empty feeding station can be disasterous.

Ground feeding may be a tried method. However, continued placement of food in the same place should be avoided; as a large number of birds using the ground may attract predators and also may deposit wastes carrying disease and contaminating the food.

VII. Bibliography

Schutz, Walter E., Bird Watching, Housing and Feeding, Brice Publishing Co., Milwaukee, Wisconsin, 1963. Grades nine and up might best make use of this book which is largely concerned with construction of water and food and shelter sources for birds. There is an introduction to bird watching, and a section of foods which can be prepared.

Barton, Roger, How To Watch Birds, A. H. Yates Publishers, Inc., Rockerfeller Center, New York, New York, 1961. Probably the best introductory book to all bird activi-

ties. Informally written it, is suitable from grade five upward. Much is devoted to field techniques, as well as general information which is simple and helpful. Attracting, feeding, and photography are also included. Excellent - a must for any bird work.

Terres, John K., Songbirds in Your Garden, Crowell, New York, 1968. Suitable from grade five upward. Attracting and feeding birds is the main emphasis. It is written informally in the first person. References regarding food and plants to attract birds are excellent.

Krutch, Joseph Wood, and Erickson, Paul S., A Treasury of Birdlore, Doubleday, Garden City, New York, 1962. Contains literary pieces regarding flight, family patterns, birds of a feather, birds and men, and extinction and conservation. Essays are short and interesting. Grade seven onward.

E. Chow Chewing Checking Charting

I. Introduction

The purpose of this activity is to determine at which time of the day birds feed most actively. In most cases the observations will be made at a feeding station which the students establish. This activity will take place after the stations from a previous activity have been up for a while; so the birds have had a chance to learn that they can depend on the station for food. The activity consists of observations made over a period of time so that the pattern may be determined. No special equipment other than a feeding station is needed, and the activity can be conducted by students from grade three upward. Results are presented graphically.

II. Questions

1. To lead into the activity ask:
   a. What does a bird do most of the day during the non-breeding season?
   b. Where do birds feed?
   c. How much of a day is spent in pursuit of food?
2. To initiate the activity ask:
   a. Do birds have a feeding period pattern?
   b. How closely does it coincide with human patterns (breakfast, lunch and dinner routine)?

c. How regular are birds in their feeding periods from day to day?

3. To continue the activity ask:

a. Is determining feeding periods from making observations at a feeder accurate?

b. Can the data be represented graphically?

c. What are possible explanations for why a pattern was or was not formed (based on the outcome)?

d. When are birds in the most avid pursuit of food?

4. To expand the activity ask:

a. What can interfere with or interrupt feeding patterns?

b. Does the metabolic rate of a bird differ from that of men?

c. Which foods provide the most energy for birds?

d. What are the nutritional and caloric requirements of birds?

5. To evaluate the activity ask:

a. How diligent were the students in pursuit of data?

b. What was learned in terms of process?

c. What was learned in terms of content?

d. What was the enthusiasm level of the students.

III. Equipment

1. Feeding stations

2. Feed
3. Data sheets - pencil, graph paper
4. Camera
5. Binoculars (if helpful)
6. Bird blind (if needed)

IV. Procedure

Establish standard observation times. These may be every 10 minutes, hourly, four times a day, etc. Establish who will collect data and when. During the observations, count only the numbers of birds using the feeders. An estimate may be made for times of great activity. Plot these numbers on a graph with numbers of birds as the y-axis and the time intervals on the x-axis. Evaluate the results. This activity might well expand into a study in which students observe the feeder activity over one or several 24-hour periods.

V. Past Studies

Students usually find a marked decrease from morning to noon with a slight increase in activity toward evening. Weather is often found to upset that routine.

VI. Limitations

Observation time may be difficult, as bird activity does not necessarily coincide with class time. In this case, the students will have to collect data outside class time. If

birds are not attracted to the feeders, then the activity must be relocated, perhaps to take place as a weekend field trip or near a feeder that is already established.

VII. Bibliography

Van Lausch-Goodall, Jane, Tool-Using Bird: The Egyptian Vulture, National Geographic Magazine, Washington, D.C. 20036, May 1968. Suitable from grade seven upward. Describes a bird who uses tools and the expedition.

CHAPTER 6

The activities in this chapter are transitional activities which provide students with an opportunity to carry the activities of Chapter 3 to greater depths. Several of the expansion questions in Chapter 3 are dealt with in this chapter. Students should be able to relate these pertinent parts of these studies to human populations. The skills developed by this point should provide the students with the necessary background to plan and carry out activities of their own at the operational level.

A. Canine Customs

I. Introduction

This is a survey-type transitional activity for grades five and up that is done in connection with a "Dog Walk". It has implications to both Approachability (Ch. 3-D) and Territorial Imperatives (Ch. 6-C) and is a very simple and exciting activity to do.

II. Questions

1. To lead to the activity ask:
   a. Do dogs shave?
   b. How do dogs protect themselves?
   c. Do dogs specialize?
2. To initiate the activity ask:
   a. How do they accomplish all this?
3. To continue the activity ask:
   a. Do pack sizes vary?
   b. Do packs inter-act?
4. To expand the activity ask:
   a. What might make pack sizes vary?
   b. How constant is a certain pack size?
5. To evaluate the activity ask:
   a. Were the students able to relate pack size with environmental factors?

b. How accurate were the pack-size frequency estimates?

III. Equipment

No special equipment is needed except that which is needed for a dog walk.

IV. Procedure

During a dog walk have the kids keep tabs on the packs, their size, frequency, body language, intra-pack distance, and activities.

V. Limitations

Just those present when working with feral dogs (see Limitations of "Approachability" Ch. 3-D).

VI. Past Studies

Students and teachers in Cleveland, Ohio, made a brief study of packs and their behavior in the summer of 1972.

A graduate student at Johns Hopkins University in Baltimore, Maryland, made a study of dogs, their packs and behavior for his thesis.

VII. Bibliography

Klopfer, Peter H., Behavioral Aspects of Ecology, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1962. A very good, concise book dealing with topics such as "Why don't predators overeat their prey?" "How are food and space shared between species?" "Why does species diversity

vary?" "How are species kept distinct?" and "How are communities organized?" It is too technical at times and the subject index is lacking, but overall it is thorough.

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Schaller, George B., Predators of the Serenget: Part 2, Natural History Magazine, American Museum of Natural History, New York, New York 10024, March 1972. An excellent article overall, this part (#2 of 3) has a very good account of the activities of naturally wild dogs.

Ardrey, Robert, The Territorial Imperative, A Personal Inquiry into the Animal Origins of Property and Nations, Kingsport Press, Inc., Kingsport, Tennessee, 1966. Robert Ardrey takes a concept familiar to every biologist

(that of territory), and brings together for the first time a fair sampling of this form of behavior and demonstrates that man obeys the same laws as (other) animals.

Frame, George W., Wild Dogs of Africa, Science Digest, New New York, New York 10019, June 1970. A good article about how wild dogs (in packs) behave in an undisturbed environment.

B. Dog Show

I. Introduction

This transitional activity is good from grade five upward as it gets students out of the classroom. It also can motivate some otherwise hard to motivate students. A full day will be required, but don't forget weekends and independent projects for extra time.

II. Questions

1. Questions to lead into the activity:
   a. How do you find out things?
   b. How can we show others what we've learned?
2. Questions to initiate the activity?
   a. What people do we want to reach?
   b. Would they respond to a movie?
3. Questions to continue the activity:
   a. What should it be about?
   b. How should we present it?
4. Questions to expand the activity:
   a. Should we include how we learned what we did learn?
   b. Would that change the emphasis?
5. Questions to evaluate the activity:
   a. Was the movie representative and not biased or one sided?

b. Was it effective for the target people?

III. Equipment

Movie cameras, editing equipment, projector, narration equipment are all needed for this activity. If the school doesn't have them, they can usually be borrowed or rented at a nominal fee.

IV. Procedure

After the class decides what the emphasis of the movie is to be and a script has been drawn up, camera crews are ready to go out and film. Editing and the addition of narration (if desired) are next. Then show it to everyone who'll sit through it: PTA's, parents, the dog catcher, the ASPCA, etc.

V. Limitations

The main limitation is that of the expense of getting the equipment and film and the film processing.

VI. Past Studies

In Tilton, New Hampshire, a group of teachers and students made a movie of a river from a spring with moss-covered rocks to the ocean and its beach. It has been shown with slides simultaneously on each side with music. It is very well received at conferences, meetings or wherever it has been shown.

At Germantown Academy in Fort Washington, Pennsylvania, stu-

dents made an excellent film on man's effects on the environment, both positive and negative. It has been shown to the school community and during Earth Day.

VII. Bibliography

A Curriculum Activities Guide to Water Pollution and Environmental Studies, Institute for Environmental Education, 8911 Euclid Avenue, Cleveland, Ohio 44106, 1970. This activity oriented Environmental Guide is the result of cooperative efforts of High School students, teachers, scientists, and technicians. The activities are divided into four chapters: Hydrologic Cycle, Human Activities, Ecological Prospectives and Social and Political factors, It has many activities which can be used as examples or as a basis for other activities.

Beck, Alan M., The Life and Times of SHAG, A Feral Dog in Baltimore, Natural History Magazine, American Museum of Natural History, New York, New York, October, 1972. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and our 5:00 A.M. dog walks have really turned people on!

C. Territorial Imperatives

(Adapted from Robert Ardrey's Book, "The Territorial Imperative")

I. Introduction

This transitional activity shows that certain ecological concepts are basic when urban or natural systems are used. In this case territory is explored as related to dogs and people. Students from grade seven upward can do it during a dog walk and in the post-walk talk.

II. Questions

1. To lead to the activity ask:
   a. Do you have a "special place"?
   b. What happens if someone is in your "special place"?
2. To initiate the activity ask:
   a. Where does the dog live?
   b. Where does he get his food? His water?
3. To continue the activity ask:
   a. How far from home does he go?
   b. What is his "home range"?
   c. Why does he go that far?
4. To expand the activity ask:
   a. Why doesn't he go further?
   b. Where do other dogs go?
   c. Why do they go where they go?

5. To evaluate the activity ask:

   a. Were the students able to figure out the home range? How?

   b. What environmental factors did they correlate with each dog's home range?

III. Equipment

Detailed maps such as topographies are the only necessities not normally found in a home or classroom.

IV. Procedure

Have the students follow several dogs, plotting all sitings on a map. Connecting outermost points (using home as center) determines the home range. Map out territories of the dogs. Add such things as food and water sources, shelter, presence of people, etc.

V. Limitations

The only hazzards are those present when normally working with feral dogs. See this section in the "Approachability" (Ch. 3-D) activity.

VI. Past Studies

A graduate student at Johns Hopkins University in Baltimore, Maryland, made a study of dogs and their territories for his thesis.

VII. Bibliography

Klopfer, Peter H., Behavioral Aspects of Ecology, Prentice-Hall, Inc., Englewood Cliffs, New Jersey 1962. A very good, concise book dealing with topics such as "Why don't predators overeat their prey?" "How are food and space shared between species?" "Why does species diversity vary?" "How are species kept distinct?" and "How are communities organized?" It is too technical at times and the subject index is lacking, but overall it is thorough.

Beck, Alan M., The Life and Times of SHAG, a Feral Dog in Baltimore, Natural History Magazine, American Museum of Natural History, Central Park West at 19th St., New York, New York, 10024, October 1972. A scientific article written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced, and our 5:00 A.M. dog walks have really turned people on!

Schaller, George B., Predators of the Serenget: Part 2, Natural History Magazine, American Museum of Natural History, Central Park West at 79th Street, New York, 10024, March 1972. An excellent article, this part

(#2 of 3) has a very good account of the activities of naturally wild dogs.

Ardrey, Robert, The Territorial Imperatives, A Personal Inquiry Into The Animal Origins of Property and Nations, Kingsport Press, Inc., Kingsport, Tennessee, 1966. Robert Ardrey takes a concept familiar to every biologist (that of territory), and brings together for the first time a fair sampling of this form of behavior and demonstrates that man obeys the same laws as (other) animals.

Frame, George W., Wild Dogs of Africa, Science Digest, New York, New York, 10019, June 1970. A good article about how wild dogs (in packs) behave in an undisturbed environment.

D. Keeping Abreast of Unrest and the Guests and the Pests in a Nest

I. Introduction

The purpose of this activity is to become familiar with the nesting activities of birds. This is done through first-hand observation over a period of time - either that of a day, or daily checks over a longer span. Because the precision of the observations can vary, so can the age range of students - no restriction here. This is primarily an awareness activity, but prolonged involvement might lead to a problem study - especially if conducted at a site where the environment is scheduled to change. Special observation equipment may be needed.

II. Questions

1. To lead to the activity ask:
   a. When do birds nest?
   b. Do all birds build a nest?
2. To initiate the activity ask:
   a. What goes on at a nest?
   b. What is the location of the nest?
   c. When is the nest needed?
   d. Is the nest being changed by the birds?
   e. Are there any eggs in the nest?
   f. Are there any young in the nest?
   g. When is the best time to observe the birds?

3. To continue the activity ask:
   a. How close is the nest to vital needs of the birds?
   b. Does the same bird who built the nest live in it now?
   c. What bird incubates the eggs?
   d. In which direction does it sit?
   e. How often are the young fed?
   f. Are the young brooded? For how long?
4. To expand the activity ask:
   a. Can generalizations be made about the birds who occupy the nest regarding the structure of their lifestyles?
   b. What relationships exist among the birds, especially male and female roles?
   c. How long will the nest be used?
   d. Of what significance are the observations?
   e. How do these compare with those of other studies?
   f. Are animals other than birds present in the nest?
5. To evaluate the students' efforts ask:
   a. How detailed were the observations?
   b. To what degree were the data evaluated and used?
   c. What was their reaction to the activity?
   d. How was their cooperation?

III. Equipment

1. Notebook
2. Pencil
3. Clock or watch

Note: The following may or may not be needed.

4. Binoculars (up to 8 X, if available)
5. Bird blind (see references in bibliography)
6. Ladder
7. Camera
8, Tape recorder

IV. Procedure

Find an occupied nest, where activity takes place.

The observer(s) should be in a good position to be able to see all that happens without disturbing the birds. A bird blind is a closed, tent-like structure which conceals the observer from the birds, but has an opening which enables observation. See bibliography for construction references. Positioning depends upon accessability, season, weather, and height of the nest.

Take detailed written notes on everything that happens at the nest. Use questions as a guide. A data sheet may be prepared in advance.

A photographic record may be helpful. Consult references on bird photography.

A tape recorder may be helpful for song studies. All observations could also be recorded and later transcribed, if the voice of the observer will not bother the birds.

A comparison of findings may be conducted. The Bent Life History Series may be of particular help (see bibliography).

V. Past Studies

During three summers of observation of different Indigo Bunting nests, one student found that the male never came to the nest.

The Bent Life History Series gives detailed case histories and covers the nesting process of every North American bird.

VI. Limitations

Finding a nest of suitable location could be a problem; the students probably will be able to assist in finding one.

Time can also be a problem - either observation periods, season, or hour. Perhaps the class should not conduct the activity during class time, but rather when conditions are best.

VII. Bibliography

Ryan, Pat, . . . and a Partridge in a Palm Tree, Sports Illustrated Magazine, January 11, 1971. Describes how an annual bird kill became a count; a team sport

at that. Suitable from grade 6 upward.

Bent, Arthur Cleveland, Bent Life History Series, Dover Publications, Inc., 180 Varick Street, New York, New York. The interested high school student will make use of this encyclopedic compilation. Detailed data are given on many species of birds on practically any item needed. Illustrations not abounding.

Star, J., The Great Purple Martin Controversy, Look Magazine August 10, 1971. An excellent example of how human activities interrupt the lives of birds; and what remedial action was taken. Focus on the mosquito problem. Grade 4 upward.

Armstrong, Edward A., The Way Birds Live, Dover, Inc., 180 Varick Street, New York, New York 10014, 1967. Students from grade 6 upward can appreciate this informally written book; illustrations are frequent. The sixteen chapters cover finding a partner, showing off, sign language, battles and bluff, courtship gifts, setting up house, about eggs, youngsters, toilet and tidiness, do birds go to school, come out and play, dancing grounds, what's for dinner, roosting rules, over the hills and far away, and how to go birding. Much is written in the first person, describing experiences of the author.

PART III

Part III Population Problem Study Activities Draft

The operational activities section is essentially an outgrowth of the first two levels. The students function individually or in groups to perform certain environmental actions or to investigate, in-depth, specific environmental concerns. They gain direct experience in carrying through investigations in which they are responsible for decision-making regarding (1) the recognition and definition of the problem, (2) analysis of the problem, (3) data processing, (5) data evaluation and (6) data utilization. The teachers' roles are primarily those of a resource persons and guides to learning.

Chapter 7 Operational Activities

Four approaches are presented as initiators of action. The teacher is encouraged to examine each approach and to select one or more which he feels is appropriate for his class. Each approach deals with problem solving in a somewhat different manner. These are merely guidelines with some suggestions to start the students. The interests and abilities of your students may necessitate a variety of changes. Feel free to make any additions or modifications necessary to meet these needs.

Each approach requires a certain investigative level in which students are required to examine their findings and to determine what potential impact these findings might have on community action. If recommendations for action are called for, the student(s) must

CHAPTER 7

consider the action and the alternatives to this action as they relate to a variety of political, economic, legal, social and technological factors.

Through these activities the students realize that they have definite roles as community members. They become aware of the complexity of both natural and man-made systems and of the fact that they have a responsibility that extends beyond their own interests and needs. Outgrowths of these activities include a greater concern for social responsibility, a consideration of environmental ethics and a greater awareness of potential career opportunities.

Chapter 7 Draft

A Realistic Environmental Problem Simulation (REPS)

REPS allows a group of students to realistically simulate a probable sequence of events related to an environmental problem a year or more into the future. The simulation is based on a real problem in the students' environment, and the students play the roles of all the important people involved in the problem. During the simulation time passes relatively quickly, thus allowing the students to speed up the normally slow ecological, economic, political, and social processes.

Before moving to the details of REPS, the differences between REPS and other simulations and games will be discussed. There is a continuum of types of games and simulations; some games closely resemble simulations and vice versa, whereas others are very different. The following paragraphs highlight some of the differences and similarities.

Both games and simulations have rules. Rules provide for timing, actions, the evaluation of actions, a record of actions, and final results. The devices necessary to carry out the rules are often very different; however, essentially they are there. A second similarity exists in that control personnel are required to manage effective games or role simulations. These similarities are the major ones of such enterprises.

The differences deal with more detailed aspects of games or role simulations. Most simulations are hypothetical in nature, while REPS is real. The dealings which are carried out among players vary also. Usually the dealings are carried out indirectly, that is to say, the record of player actions is usually something such as a board or wall chart or a physical entity of some sort. The players, therefore, deal with the physical entity and through it, each other. In REPS, all action is taken through communications, which provide for a direct dealing with other players. The record of dealings is maintained as a subsidiary concern. Therefore, the status of a role simulation may be in doubt at a given time because a physical entity such as a board or chart may not be observed readily to determine the relative positions of all players or teams. This in itself is closer to reality than a chart or board. The timing in games and REPS also is in contrast. In games, the amount of time required for moves or between moves is not usually considered to be of great importance. In contrast, in REPS, the timing relative to real life is in a particular ratio; for example, one month in real time may be simulated as ten minutes or fifteen minutes during REPS. Another area of contrast is in the preparation to participate in the game or REPS. In playing games, the background, hypothetical in nature, is easily assimu-

lated. A brief description and the rules of the game determine how a player plays. In contrast, a great deal of research is required to play a role in REPS.

REPS has many educational merits. These merits are not exclusive to REPS, but they certainly do provide an exciting combination. The merits are expressed from the students' points of view. One of the things that impresses and motivates the students most readily is the fact that they are participating in a study of something that is real. A correlary to this is that they have helped determine what it is that they are going to study, and the study is inter-disciplinary in nature. In fact, the various subject headings that a student is pursuing at a given time cannot be defined because the combinations found in real problems are very complex. Another merit of the program is that the teacher can learn along with the students. Very often teachers are handicapped by the notion that they must know everything that the students are to learn. Experiences related to REPS indicate that perhaps this notion is neither desirable nor necessary. One of the greatest examples that can be provided for students is the teacher in the process of learning. The students are allowed to work under a variety of conditions and circumstances while pursuing the various aspects of a REPS. They, of course, do a lot of their research as individuals. However, when they

are participating in the simulation they work as teams, and as their ability and confidence increases with their teams, they learn how to listen to other people while motivated by a desire to contribute. In this process of interaction, the students also learn to compromise. They spend a great deal of time doing this to establish a position for their team. Since the simulation is carried out by sending and receiving messages, communication is emphasized. At first, messages are sent at a very brisk pace, the communicators concentrating on what they want others to know and do. Usually, they pay very little attention to those messages which they are receiving. In 30 minutes of unlimited message sending and receiving, students quickly realize that others do not understand what they (the students) wish to have them understand. At this point, the students develop a very serious and purposeful attitude toward helping others to understand. During the research phase, the students become aware of the many skills required to solve problems. As the simulation progresses, they understand the importance of having the skills. Perhaps one of the most important outgrowths of REPS is that the students are allowed to determine that they have to acquire skills to solve problems. Once a student has determined that he has a need to develop skills to deal with the realities of life, his capacility for growth is greatly enhanced. He is very willing

to amplify his own powers by pursuing broad and diverse cultural objectives.

An interesting by-product of the simulation which was not originally envisioned is the understanding of cognitive and affective domains and their relationships. A great deal of emphasis in education today persists in the cognitive area while the affective areas are somewhat shortchanged. Once the student has a significant exposure to REPS, he perceives the importance of considering objectives in the affective domain, that is, he sees the significance of many aspects of his life style as it is developing and as it is being modified.

The REPS is divided into sequential sections. Each section involves a process and product. The first section describes the selection of the REPS, and how the background is developed for that REPS. The second section contains the rules for the simulation and descriptive material on the control and participation roles. A broad variety of circumstances may be dealt with effectively. REPS have been completed in as little time as one day; on the other hand they may take as long as a month and a half.

I Selection

The REPS depends on the selection of a proper subject. Many factors enter into the selection process, but the most im-

portant single factor is the interest of the participants. Therefore, the subject or problem to be considered for the REPS must be something that interests the participants. At this point, we have not had any REPS that have failed because of a poor subject or problem selection. The problem usually enlarges itself to fit the number and the maturity of the participants. Selection of a problem which could be simulated by less than 15 students would be difficult if the problem is to be covered satisfactorily. To choose a problem that is too small would be difficult. Because the selection process requires compromise on the part of all individuals involved, you should consider the selection over a period of time. To introduce the subject with a few moments notice would be unwise if the participants did not have a basic awareness of their environment. That is to say, you can't spring a problem on a relatively unsophisticated audience.

From the following two examples, the reader should be able to get a feeling for the selection. A land use problem which was to be studied for approximately two weeks on a full-time basis by 20 people was selected over a period of about three days. Only four or five people participated in the selection

process; however, those doing the selection had broad experience. Students and teachers were both represented. The most rapid selection process experience thus far took approximately 20 minutes. Ten teachers in a one day in-service program selected an environmental problem for study. It was a focal point in the local press. The selection of this particular problem was a natural for the group. These examples represent two approaches to the selection process. One that might occur more frequently would be to briefly (in a matter of minutes) introduce the idea that people can play roles to simulate an actual problem, and then ask the students to spend some time discussing with their parents a problem that might be important to the community in the area in which they reside. The following day, a class period could be devoted to discussing the types of problems which were brought out by the parents and students the previous evening. Those items which the students are most enthusiastic about would be the items to pursue. Often, the items brought up in discussion represent facets of a larger problem.

Usually the items discussed are symptoms of the real problem or are phenomena that may be readily observed at very low levels of awareness. If the topics can be narrowed down in

a day's discussion, additional time might be devoted to the problem at the next class meeting after the students have had an opportunity to further discuss the selection with their partents.

There appears to be a risk factor at this point on the part of the teachers. Whenever discussions not based on lesson plans or text books develop in classrooms, the teacher runs the risk of not having very much information on the subject at hand. A teacher might feel this is risky business, however, it represents one of the best opportunities for students to see someone "thinking on his feet" or better still, it represents an opportunity for teachers to learn from students. This occurs more effectively when teachers are listening.

The selection process continues as the symptoms are translated into a set of causes which begin to define an environmental problem. At this point, the discussion should turn to causes of the problems. An effective way to handle this is to simply list those people or functions which are causing the problem. If a person or organization is allowing a problem to develop or to continue to exist, then the group should look to see who allows that person to continue doing the wrong thing.

As the discussion continues, more and more names of people, jobs that people perform, and organizations that control the things that people can and cannot do will appear.

When more names or descriptions are not forthcoming, let the discussion turn to classifying those items which appear on the list. Usually four or five major classifications emerge. These major classifications represent the teams that will participate in the REPS.

II Scenario

The scenario is a background statement which acts as a source document for the research phase of the REPS. The scenario is divided into parts which correspond to the four or five teams identified in the problem selection process. The scenario is completed as a two step process: (1) the gathering of all pertinent data and (2) compiling and publishing.

The data are gathered by temporarily assigning the participants to study groups. For a class of 35, five teams of 5 to 8 students could be formed. Let the participants work in study groups for several hours or class periods to define the scope of the simulation teams. Typical teams representing local government, state government, federal government,

agencies, citizens' organizations, business, industry, etc., will be formed. The group should determine the names and positions of many important people. The relationships of these people to the problem should be blocked out also.

Once the study groups have roughed out the initial list of names and relationships, participants should rotate to other teams. At this point interviews, phone calls and letters may be written to secure basic information about the important people. More names and agencies will be added to the list. After some progress has been made the relationships should be refined through group discussion. The groups should rotate through all teams so the participants have some experience in each team area. Don't worry about the complications of receiving mail and dealyed interviews. The participants can pass the mail along and appointments may be kept by future group members. All that is needed is a log or bulletin board which notes future commitments for action relative to each simulation team.

The scenario may be written when the last study group rotation occurs. Each study group assembles the materials (those which have been written from interviews, letters, pamphlets, and other documents) into a background package.

Thirty students at Germantown Friends carried out the above procedure in 1 1/2 weeks (full-time effort) and assembled a five-section, 320 page document. Three days were needed to print, collate, and bind. Usually the document is under 100 pages and is dittoed by hand. There is little need to number pages consecutively but it is handy to use section oriented paging such as II-3 or C-15.

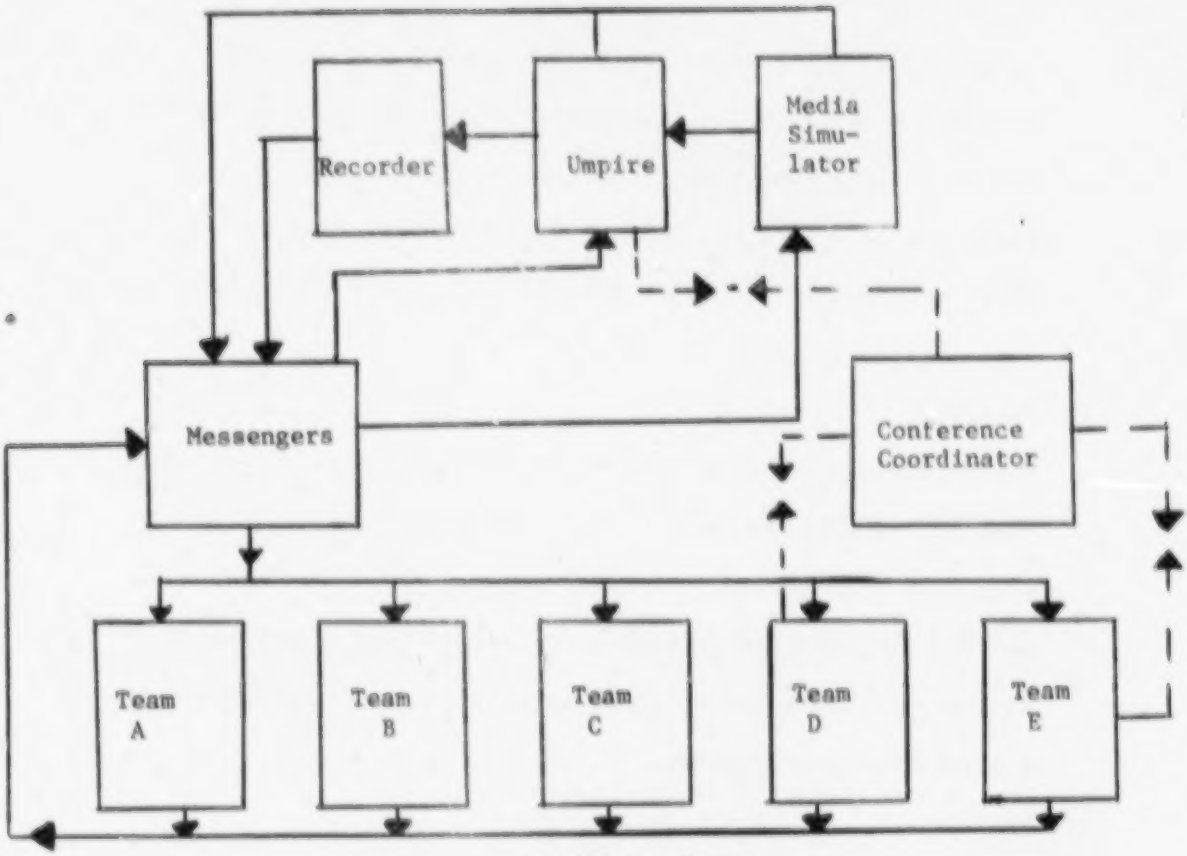
III Research

The participants choose individual (or agency) roles and group into the simulation teams. Then each researches his role using the scenario as a starting point. The scenario is most helpful for him when he wishes to learn of his relationship to others. The research phase is an in-depth study and requires a detective-like attitude.

IV Simulation

The basic organization is shown in the figure below. Five functions are performed by a control group in association with the simulation teams. The control group consists of an umpire, a recorder, a conference coordinator, a media simulator, and a team of messengers.

All communication during the simulation takes place via written messages. Messages originate from the teams and are carried by messenger to the umpire.



Simulation Teams

The umpire validates the message by writing "valid" in the lower left corner of the message blank. The judgement of whether or not the message is valid is determined by considering its rationality, i.e. is the message one that would be submitted by a person playing the particular role or is it something not in the realm of possibility. The umpire also makes judgements affecting the operation of the simulation. If, during a particular stimulation a reorganization

of some sort is needed, the umpire can stop the simulation to effect the necessary repairs.

The recorder keeps a running log of the messages and the order in which the messages are dispersed. When the recorder gets the message from the umpire who has validated it, he will put a number on it indicating the order in which the message was received by him. He will also, for further reference, put the time at which he received the message to the nearest minute. Then he will deliver the message to a messenger who will distribute it to the various teams.

Under certain circumstances, a team may wish to communicate with another team secretly. Under these circumstances, the team originating the message should write "secret" next to the word subject on the message form so that the recorder will know it's a secret message. When the recorder receives the message, he will distribute it immediately through the messengers to the indicated recipient. The recorder will hold the remaining copies of the message for a period of fifteen minutes and then have the messengers distribute the remaining copies to the remaining teams.

The media controller simulates the manner in which the media would cover the particular events transpiring. The principal function would be to combine the effects of several individual messages on a situation and comment on them in an editorial way. If the simulation fails to become dynamic and active, the media can stimulate it by introducing messages that would throw new light on situations which should be developing.

The conference coordinator accepts requests from various teams when they wish to meet with other teams. A conference may be held between two teams. The time limit on a conference is five minutes. The coordinator will send a message indicating when and where it will be held. The time he indicates as the beginning of the conference determines the end of the conference, i.e. five minutes later. The participants must arrive on time (with a spokesman) in order that the conference will move swiftly under the direction of the conference coordinator. The short duration of the conference precludes many topics being discussed; therefore, the conference should be for a particular purpose.

The messengers continually circulate and act as extensions of the umpire in many cases. They carry messages back and forth and try to clarify the game situation for the various teams. The particular emphasis is on the rules and how to interpret the rules.

The rules for REPS are as follows:

1. During the simulation the members of the teams must stay in the rooms designated for the teams. No communication among teams may take place directly except in cases of conferences which are prearranged.
2. During the simulation, the period of time representing one month transpires in ten minutes. That is to say, during every hour of the simulation, one half year has transpired.
3. Conferences may be called by sending a message to the conference coordinator. The conference coordinator will reply to the message with another message indicating the time and the place of the conference. The conference may last no longer than five minutes; therefore, do not try to take on too many things in a five minute period. Conferences are limited to discussions between two teams.

4. If teams have press releases which they wish the media simulator to handle, they should fill out the message form with the material to be covered by the press and direct it to the media simulator.

5. All messages will be sent to all teams at the same time, unless the messages are marked "secret". If the message is marked "secret" in the box marked "subject" by spelling out in capital letters "secret", then the recorder will only send that message to the team designated; however, after a fifteen minute delay, that message will be sent to the remaining participating teams. When teams receive copies of the messages that they have sent, they will know that everyone is in possession of the secret information.

V Recapitulation and Outgrowths

After the simulation is over, a thorough discussion of what happened will take place. This happens informally because the participants cannot prevent it from happening. Almost without exception the students will wish to repeat the simulation from a certain point in the simulation. They will also wish to do more research before a repeat. If possible, plan for and allow this to happen. Other things also happen. Usually students discuss the rationality of the simulation

and they also wish to take actions they feel are necessary to deal with the problem they simulated. The teacher should consider these action-oriented outgrowths as powerful potential learning experiences.

VI Bibliography

Chesler, Mark, Role-Playing Methods in the Classroom, Science Research Associates, Inc., Chicago, Illinois, 1966. An excellent introduction to role-playing and its place in the classroom. Presents rationale as well as application.

Kersh, B. Y., Classroom Simulations: A New Dimension in Teacher Education, NDEA Title VII, Teaching Research Division, Project No. 886, Washington, D.C., 1963. A general introduction to simulation and its applications in the classroom.

Klietsch, Dr. R., An Introduction to Learning Games and Instructional Simulations: A Curriculum Guideline, Instructional Simulations and Co., 1969. A rather technical introduction to games and simulations. Orientation is social-psychological.

B Contract Projects for Community Action

A contract approach is suggested for classes in which there is a wide diversity of interest and ability. The contract approach described below is somewhat more flexible than most described in the literature. The activities are listed according to degree of complexity. Competence criteria are set as parameters for successful completion. Each project activity is school or community oriented and emphasizes problem-solving.

Teachers are asked to avoid failing students who do not complete an activity or who show little or no initiative to perform an activity. If possible use an incomplete grade rather than a failing grade. Low ability students will require additional help and direction. The teacher functions as a facilitator and should help guide the students toward completion of their projects. The grading system set up below includes grades A,B,C and F. The grade of D is used for those students who fall short of the expectations set forth in the grading categories. If the student fails to meet his contract but completes some of it, his grade is then a D. The C grade is stated as the minimum because many low achievers will strive to complete the activity. The students should not be told a D grade is available.

A contract approach is often set up as a do or fail approach. This is done to establish initiative for achievement. The activities are broad and allow the students to select the activity that best suits their interests and abilities. The learning process is then almost totally placed in the hands of the student thus mitigating the threat of failure by the teacher. The student can no longer say the teacher failed me. He must admit he failed himself. If the approach seems a bit hardnosed to the student, he might be reminded that contracts in business must be met or the company could be penalized or even go out of business.

For a grade of C you must complete, to the satisfaction of the teacher, one of the activities listed below. Once you have selected the activity you must submit a statement to your teacher which includes the following information: name, date, activity selected, a step-by-step listing of what you are going to do and an estimated date of completion.

1. Make 4-6 posters (2 feet by 3 feet approximately) which illustrate the problems of solid waste. You may look at the problem locally or nationally. The posters should be aimed for elementary school age children. Once you have completed the posters present them to your teacher for approval. Then, present the posters to a teacher or the principal of an

elementary school. Your posters will be used to illustrate the problems of solid waste and solid waste management to students in that school. Ask the teacher involved or the principal to write you a letter stating the reactions of the students to your posters so you can have some feedback.

2. Volunteer your services to one of your local agencies involved in recycling.

   What are their needs?

   How can other people help?

   What is their function?

   Where are the foods recycled?

   How much are their management costs?

   What are their profits?

   How do they use these profits?

3. Visit a sewage treatment plant. S-e Transitional Activity I.

4. Make a list of all the industries in your community. What products do they make? Visit one of the industries. Find the answers to the following questions:

   a. What raw materials do they use in processing?

   b. Where do these materials come from?

   c. At what level of efficiency do they operate?

   d. What factors go into the final cost of the product?

   e. What is their profit margin on single items?

f. What are their waste products?

g. Are these waste products discarded?

h. Are there any attempts to re-use the waste in some form?

For a grade of B you must complete one of the activities listed below. In order to meet the contract you must complete the activity to the satisfaction of the teacher. Once you have selected the activity you must submit a statement to your teacher which includes the following information: name, date, activity selected, a step-by-step listing of what you are going to do and an estimated date of completion.

1. Examine the biodegradability of a variety of substances in a landfill operation. For help see activities J. Landfills Basic, and L. Landfills Advanced. Be sure to keep a record of each step you take in this activity. Use the following guide as the basis for your report.

   a. What are you trying to do?

   b. How did you set up your experiment? List each step.

   c. What observations did you make?

   d. What do these observations indicate?

   e. Answer the questions in the activities, J. & L.

2. How can you get trash barrels put on the main streets in town? Find out who is responsible for the trash cans. How

do you see to get additional cans put out? Find a way (legally) to add one more trash can to your community. In order to do this you must be able to present a case for having it in the location you select. Present a report of your work and findings to your teacher when the task is completed.

3. Is the air in your community polluted with particles? Complete Activity H.
4. Examine your school library. Find out what materials the school has on the environment. Write to at least five industries or agencies for free materials. Find out from the Librarian how books are ordered. Who is responsible for ordering the books desired in the library? Does the Librarian have access to government publications? Can the school get government publications free? How can you receive a list of these publications that come out of the government printing office? Write to the Environmental Protection Agency for free materials. Use this as one of your five letters. Another suggestion is to write to Anheuser-Busch, Inc., 721 Pestalozzi Street, St. Louis, Missouri 63118, and ask them for their book, A Pledge and A Promise.

For a grade of A you must complete one of the following activities to the satisfaction of your teacher. Remember, in order to meet the contract the activity must be completed. If you wish to modify the activity you may do so with the approval of your teacher.

In any case you are required to submit a statement to your teacher with the following information: name, date, activity selected, a step-by-step listing of what you are going to do and an estimated date of completion.

1. Investigate the waste disposal system of your school. Find out how the school disposes of its wastes. How much waste in pounds is discarded each week? What is the cost/year of the disposal method in use? What are the relative advantages or disadvantages of switching to a shreader-compactor? Can this waste be recycled and save the school money? Would the manufacturer of such a system buy the waste from the school? Ecologically how does the system now in use compare with a shreader-compactor?
2. Examine your school library and your community library. Find out what materials are available on the environment in each. Make a bibliography of available materials. Find out how more environmental materials can be added to each library. To what extent, if any, is there a duplication of effort and materials in each library? Write to 10 agencies or industries requesting free materials. Make a copy of each letter sent and give to your teacher. Some suggested sources of materials include: Anheuser-Busch,Inc.; Scott Paper Company; Environmental Protection Agency; HEW's Office of Environmental

Education: Sun Oil Company; the American Chemical Society. For additional information, see the listing of addresses in the Appendix, pages A-30, A-31.

3. Make a litter survey of your community. Find out how much litter is discarded on a major street in town. Calculate the weight discarded. Categorize the amounts of various items discarded. Use the following categories: paper, glass, cans, plastics and miscellaneous. Since the activity requires that you pick up the litter in one section of your community, be sure you do a thorough job of it. Come back a week later and note how much waste is discarded; weigh it and again categorize the items. How much waste is discarded on this street per week? Are the items recyclable? Calculate from your findings how much money the trash is worth in terms of recycling. You will need to find out the going rates for paper, glass and cans. Calculate how many miles of roads there are in your community. If the section of road you investigated is representative of the community as a whole, figure out approximately how much money in recyclable trash is discarded/month in your town. Write up your findings using the following guidelines:

   a. What are you trying to do?

   b. How did you set out to do it?

   c. What are your findings? Use graphs, charts and all calculations necessary.

d. What do your findings mean?

4. Take the activity H. Ecologically Yours. Make a survey to find out how many people in your community do any of the suggestions listed. Ask them what other ecological activities they perform and add them to your list. Tabulate all your findings. How can you make people respond to doing the suggested activities? Make at least 3 suggestions. When you make a survey you must use as a base 100 families. Find out the number of families living in your community so that you can get a picture of the entire community. When you do the survey be sure to talk with people from different parts of town. One way of gathering a random sample is to ask the questions on your list to people shopping at a major store in town or to stand on a street corner. Try to get permission from a store manager to set up a table either in or in front of the store. Be sure you find out if a person actually lives in town before asking him to fill out the questionnaire. You may want to use your questionnaire in more than one part of town. The more information you collect the better your results. Ask your teacher for help in making multiple copies of the questionnaire.

The above listing is a partial one. Some students may have ideas of their own. The teacher should allow those students with special interests to write up their own

contract for approval. If students wish to work in groups, then the suggested activity should be expanded somewhat. When a contract is written for a group of students the role of each student should be designated. A contract is essentially written for each group member. This is done to protect the group from a student who might not meet his part of the contract.

C. Debating

Debates are often used to help students focus on the issues in a problem situation. For this reason they have been extensively used in social studies classes. Until recently, debates have been relatively uncommon in science courses. With the growing emphasis on multidisciplinary education, social-scientific issues such as those of solid waste management are becoming far more common in science courses. As such, debating of these issues is seen as a viable approach toward problem-solving.

In setting up a debate certain guidelines need to be followed. First, the students should decide what they want to debate. If they have difficulty in selecting a topic area, then a list of suggested topics might be provided. Do not assign an affirmative or negative position until the topic has been researched.

In order to achieve total involvement more than one topic should be selected. Each student should be provided several days to research his topic. Make sure the students are familiar with the resources available to them, most notably the Readers Guide to Periodic Literature.

Provide a class period to become familiar with the various

resources.

On the day of the debate write the proposition clearly on the chalk board and indicate clearly which students are supporting the proposition and which are not. Each group should have an opening statement to support its stand. No more than four students should be in a group. Large numbers of students tend to address themselves to one another rather than the whole class.

Students are to follow the following guidelines:

1. Show respect for your opponents.
2. Show respect for your opponents' views.
3. Avoid argumentation without logical defense.
4. Do not interrupt. You must wait your turn.
5. You must take notes on your opponents' statements so you have a basis for defense or logical argument.
6. Cross-examination techniques may be used. You may question your opponents' stand rather than support your own if this is necessary.
7. Ten to fifteen minutes should be allowed for class questions at the end of the debate. Do not entertain any question from the class during the debate.

Debates provide students with an opportunity for self-expression and rational thought in a courteous atmosphere. In researching a topic the student gains competence in an area and thus feels more confident in being able to substantiate his stand. Debating provides for a gaming atmosphere which is more acceptable and interesting to students than a project report or lecture. In a gaming atmosphere more total involvement by class members occurs. When related topics are researched by the entire class overlaps are seen in class discussions after each debate. Each person has a role to play and is reinforced in his position through exposure to the various views presented.

Suggested solid waste issues include:

Resolved: Every family in this community should be required to recycle its newspapers, bottles and cans.

Resolved: Disposable bottles should be banned.

Resolved: Automobile manufacturers should be required to make automobiles that are guaranteed to last a minimum of five years.

Resolved: Open dumps are a health hazard and thus should be banned.

Resolved: Styrofoam use should be banned because of its inability to degrade.

Bibliography

Samalonis, Bernice L., Methods and Materials for Today's High Schools, 1970, Van Nostrand Rumbold Company, New York.

Presents a collection of teaching methods, their uses and applications.

D Modeling

Modeling utilizes several educational methods, including creative dramatics, role playing and gaming. A model of an environment or an environmental situation is established either by the students or the teacher. The environmental situation deals with one or more concepts which is developed through problem solving techniques. The students are called upon to listen, discuss, consider opinions and judgments, and make decisions related to the problems inherent in the situations as expressed.

Skits provide a modeling approach which is convenient and easy to implement and interesting to most students. Skits allow for the creative development of concepts and provide for behavior directed toward environmental ethics. Students who have difficulty writing generally find they can express themselves better through dialogue. Dialogue tends to illuminate subtleties of thought which are often missed in prose. The skit also provides a non-threatening means of evaluating the students' understanding of the problem situation.

Students, who wish to write their own skits, should first decide which problem they are to deal with. They should examine the problem in terms of the factors that cause it, the attitudes of society toward the problem and possible corrective measures to deal with

the problem. Students should briefly outline the above factors and use these to help structure their skits. An environment or environmental situation is then selected. Action and roles are established and the script is then written. Each group of students should be allowed the opportunity to run through their skit before the class so that class input may be solicited before the final copy is written.

Gaming techniques provide an added dimension to modeling. Games are difficult for most students to develop on their own unless they have a prototype they can use. One game which is available free to teachers is Man In His Environment. The game was put out by the Coca Cola Bottling Company and is free on request to teachers. The game centers around the fact that all elements of the environment are interrelated and interdependent. The game requires students to examine the advantages and disadvantages of making changes in an environment. Decisions are made to include or exclude these changes by the representative groups. The game is suggested primarily because it examines many of the factors studied earlier by the students and because it has a problem focus.